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Predictors of Full Childhood Immunization Status in Owerri, Nigeria

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Abstract

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MPH, University of Calabar, 2008

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Dissertation Submitted in Partial Fulfillment

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Abstract

Full (complete) childhood immunization against tuberculosis, poliomyelitis, diphtheria, tetanus, hepatitis B, yellow fever, measles, and the maternal retention of immunization documentation are the most cost-effective interventions against vaccine-preventable childhood diseases. The full childhood immunization rate in Nigeria has not reached the expected target level of compliance at 90%. Using the social ecological model, this study investigated the influence of maternal satisfaction with postnatal services and paternal support on full childhood immunization status; it also examined the association between maternal factors and the maternal retention of immunization documentation in Owerri, Nigeria. The hypotheses were that maternal satisfaction with postnatal services and paternal support were associated with full childhood immunization status. This study was a quantitative, cross-sectional survey design that included validated modified WHO/EPI-30 cluster immunization survey information from the cluster sample of 560 mothers of children between the ages of 12 and 23 months old. The multivariate logistic regression analysis (at the .05 level) indicated that the odds of full childhood immunization status were lower for participants who indicated no maternal satisfaction with postnatal services compared with those who indicated satisfaction with postnatal services. Public health workers and policymakers should invest more resources in maternal and child health care resources to increase maternal satisfaction with postnatal services. The study outcomes may help to evolve a system that may increase childhood immunization status and reduce vaccine-preventable diseases in Owerri, and serve as a model for other countries.

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Dedication

To God Almighty through our Lord Jesus Christ I dedicate this dissertation. I thank God for using early missionaries to establish schools in my village, Addi, Abaja, Nigeria, where I commenced my primary education. My darling wife, Mrs. Roseline Osuala, who has been supportive to my academics and make life joyful for me, I thank you. I also appreciate my son, Titus, and other family members whose contributions are constructive to the realization of my educational dreams.

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Chapter 1: Introduction to the Study

Background of the Study

One of the most innovative intervention strategies in public health in the 20th century is immunization. The world eradicated smallpox through universal smallpox immunization (Oyo- Ita, Fakunle, Fajola, & Edet, 2012). The World Health Organization (WHO) introduced Expanded Program on Immunization (EPI) to ensure universal immunization of children against childhood vaccine-preventable diseases. WHO and United Nations Children Emergency Fund (UNICEF) jointly estimated two to three million deaths from some of these diseases are prevented annually through immunization (WHO & UNICEF, 2013). WHO and UNICEF (2013) further indicated that the prevention of 17% of deaths among 0-59 months old children is possible if the world vaccination rate had reached the optimal level. In this study, I examined whether paternal support and maternal satisfaction with the postnatal services predict full childhood immunization status (taking all recommended childhood immunizations) and investigated the association between the maternal retention of immunization documentation and maternal factors.

Immunization and Child Survival in Nigeria

There are some diseases that disproportionately target children and result in higher adverse events such as death and disability. Some of these diseases in sub-Saharan Africa and Nigeria are diphtheria, measles, tuberculosis, poliomyelitis, tetanus and

neonatal tetanus, pertussis, hepatitis B, and yellow fever (WHO & UNICEF, 2013). Fortunately, vaccine can prevent these eight diseases. I cannot present the background information on the diseases in this chapter due to space limitations. The reader is referred to chapter 2 for the explanation about these diseases and their vulnerability.

Before the vaccination era, these diseases occurred globally, especially in tropical Africa and Southeast Asia (Aylward, 2008; Duclose, & Helperin, 2008; Hornick, 2008; Strebel, &Hersh, 2008). Epidemics of measles and pertussis were occurring in most global communities every three and five years respectively (Strebel & Hersh, 2008; Duclose & Helperin, 2008). Vaccination has a noticeable impact on the reduction of disease burden locally and globally. To benefit from the immense potential of vaccines in relation to preventing childhood vaccine-preventable diseases and increase the chances of child survival, Nigeria introduced EPI program in 1979 (Antai, 2009; WHO, 2012).

Under EPI program, before each child's first birthday, they are expected to have received one dose of BCG vaccine at birth, three doses each of DTP_w vaccine, HEB vaccine, OPV vaccine at the ages of 6, 10 and 14 weeks respectively (NPC & ICFM, 2009). Other recommended immunizations are one dose each of measles vaccine and yellow fever vaccine at six months and nine months old respectively (NPC & ICFM, 2009). A child develops protective antibodies against these diseases on the administration of all the required 12 doses. Unfortunately, only 23% of Nigerian children aged between 12 and 23months had received full (complete) EPI vaccination doses and

19% received none at all (National Population Commission [NPC] & ICF Macro [ICFM], 2009).

Protective Potential of the Vaccines

Scientists rate all the childhood vaccines very high in terms of their protective potential. Protective effectiveness of the Diphtheria, Tetanus, and whole cell Pertussis (DTP_w) triple antigen is 100% for tetanus, more than 99% for diphtheria, and 60 to 97% for pertussis (McCormack, 2012; Kostap-Petraco, 2013; Hurmez, Habeeb, & Al-Derzi, 2013). For measles, protective efficacy ranges from 73.3% for nine months old to 100% for 14 month old (Borras et al., 2011; Ang et al., 2012) while efficacy of bivalent OPV is 23.4% (O'Reilley et al., 2013). The Center for Disease Control and Prevention (CDC; 2012a) estimated that the efficacy of hepatitis B vaccine to 95% while BCG grants some level of protection against tuberculosis, with 25% as the maximum effectiveness. (Favorou et al., 2012; Pereira et al., 2012; Tchilian et al., 2011).

Statement of the Problem

The EPI, meant to protect children against child killer diseases has undergone some revisions to improve its performance since its inception in Nigeria, 1979 (WHO, 2012). However, despite these improvements, the immunization coverage rate and immunization documentation retention rate have remained unacceptably low (Abdulraheem, Odajole, Jimoh, & Oladipo, 2011; Odusanya, Afolabi, Meurice, & Ahonkai, 2008). Consequently, Nigeria has one of the worst mortality rates for children

under the age of five years (157 per 1000 live birth) in the world (Odusanya et al., 2008; 2009NPC & ICFM, 2009). While previous information about the importance of immunization in controlling the spread of disease in Nigeria is valid, there needs more of understanding on whether paternal support and maternal satisfaction with postnatal services predict full childhood immunization rate. Also, more understanding is needed on the association between maternal factors and the maternal retention of immunization documentation (immunization cards).

Factors interacting with poor childhood immunization status are not well known (Abdulraheem et al., 2011). Khowaja, Khan, Nizam, Omer, and Zaid (2012) observed that trust in government health services, availability, and accessibility of immunization services and social-demographic factors relate to childhood immunization status. Maternal education, remembering immunization due dates, knowledge of immunization benefits, community stakeholders' support are associated with childhood immunization status (Ategbo et al., 2010; Odusanya et al., 2008). Literature on the impact of paternal support and maternal satisfaction with the postnatal services factors on full (complete) childhood immunization is scarce. Study on the impact of maternal factors on the maternal retention of immunization documentation is also scarce. The study is intended to fill these gaps.

Nature of the Study

In this study, I used a quantitative, cross-sectional survey because I began with a positivist philosophy that holds strongly on quantification of the phenomenon so as to facilitate testing of hypothesis between its variables (Cresswell, 2009). In cross-sectional design, naturally occurring attributes are observed, measured and recorded at a given point in time. Cross-sectional studies can be executed timely at a reasonable cost, and the findings can be highly generalizable (Aschengrau, & Seage III, 2008). I conducted a primary survey to collect data. Survey is suitable for this study because the study area, Owerri, is a large, well-dispersed geographical district.

Also, researchers have shown that a survey is the best method of validating administrative records on immunization (He et al., 2012). A large amount of information is gathered fast and less costly from naturally occurring events (Kelly, Clark, Brown, & Sitzia, 2003). Immunization survey is the favored means of gathering information where census data does not exist or is inadequate (Burton et al., 2009). In addition, unlike administrative data, which records only segments of the population using mainly public orthodox facilities; survey can gather information from the representative population of the community (Burton et al., 2009).

Interviewer-administered WHO standard EPI 30-cluster survey forms were the principal instrument of data collection. However, this tool was adapted to suit the peculiarity of the study variables and the study area. The interviewer-administered

approach to data collection is capable of increasing the response rate (Etana & Deressa, 2012).

Samples of mothers whose children are at the ages between 12 and 23 months gave information on their sociodemographic characteristics and childhood immunization-related conditions. To select representative sample of this population, WHO's EPI-30 cluster sampling technique was the sampling method of choice. The technique is a two-stage probability sampling method. Sampling commenced with the cluster (ward level) first and later the households in each selected cluster. The technique ensures unbiased selection of respondents, improving the external validity of the study by increasing the chances of generalizability of findings.

Research Questions and Hypotheses

1. Is there an association between maternal satisfaction with postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)?

Ho_1: There is no association between maternal satisfaction with postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of

delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)

$H_{a1:}$ There is an association between maternal satisfaction with postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization).

2. Is there an association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)?

Ho_2 There is no association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization).

Ha_2 There is an association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of

antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization).

3. Is there an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_3: There is no association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)

Ha_3: There is an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)

4. Is there an association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_4: There is no association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

Ha_4: There is an association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

5. Is there an association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_5: There is no association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)

Ha_5: There is an association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of the immunization documentation covariables (marital status, family size, and family income).

Purpose of the Study

In this study, I assessed the association between maternal satisfaction with postnatal services, paternal support, and full childhood immunization status; determined the association between the maternal retention of immunization documentation and maternal factors in Owerri, Nigeria. I used primary survey to collect data from mothers

about child immunization history, retention of immunization documentation, and maternal perception of the childhood immunization program. At the same time, I used the survey to collect information maternal factors such as maternal age, maternal education level, and maternal knowledge of the importance of immunization documentation.

Theoretical Framework

Social ecological theory is the basis for this study. The theory tends to consider human behavior within its contextual framework (Golden & Earp, 2012). It concludes that the behavior is impacted and impacts interconnected factors of intrapersonal, interpersonal, physical environment, socio-cultural environment and social policy (Golden & Earp, 2012; Sallis, Owen, & Fisher, 2008). The main principles of social ecological models are that a particular health behavior relates to many influences; influences in health behavior relate to the various levels. Also social ecological model can describe a particular health behavior, and in behavioral health intervention, multiple level approach is more rewarding (Baral, Logie, Grosso, Wirtz, & Beyrer, 2013; CDC, 2009; Collins & Ibrahim, 2012; Winch, 2012).

Social ecological model originated from the Brofenbrenner's ecological systems model. Brofenbrenner applied this model to explain how the children impinge on and are affected by the environment in which they grow (Yingst, 2011). Brofenbrenner segmented child's developmental environment into five environmental systems. The

systems are the microsystem in which the child lives and interact such as family, school, peer group, which has an immediate impact on the child (Yingst, 2011). Other components of the systems are mesosystem-the exchanges between the components of the microsystem; exosystem-institutions and social policies (Yingst, 2011). The systems also include macrosystem-culture and behavioral patterns; and chronosystem-life transition and physically environmental events such as environmental disasters (Yingst, 2011).

Social ecological model has witnessed the popularity in the recent times in public health practice and research because it offered an opportunity for holistic consideration of factors at multiple levels in planning, research, and evaluation of health promotion intervention (Sallis et al., 2008). The model could also be used to understand health behavior and define essential factors that should be focused on health behavior intervention and research, thereby allowing investigation of the health services as it relates to immunization status (CDC, 2009).

Rammohan, Awofeso, and Fernandez (2012) examined the influence of paternal education on childhood measles immunization rate in the developing countries. Social ecological model formed the basis of the study (Rammohan et al., 2012). The researchers informed that factors that impact childhood immunization status could be subdivided into five multiple levels of behavior, intrapersonal, interpersonal, Community, institutional and social policy factors. The researchers acknowledged focusing on interpersonal factor

(paternal education). The study result showed that paternal education is a predictor of childhood measles immunization status (Rammohan et al., 2012).

The various influences that interact with human behavior are intrapersonal, interpersonal, organizational, community, physical environment, and social policy. Based on this theoretical framework, the study assessed the interaction between full childhood immunization status (behavior), on paternal support (interpersonal), and maternal satisfaction with postnatal services (social policy factor). It also investigated the relationship between the maternal retention of immunization documentation (behavior) and maternal factors (intrapersonal).

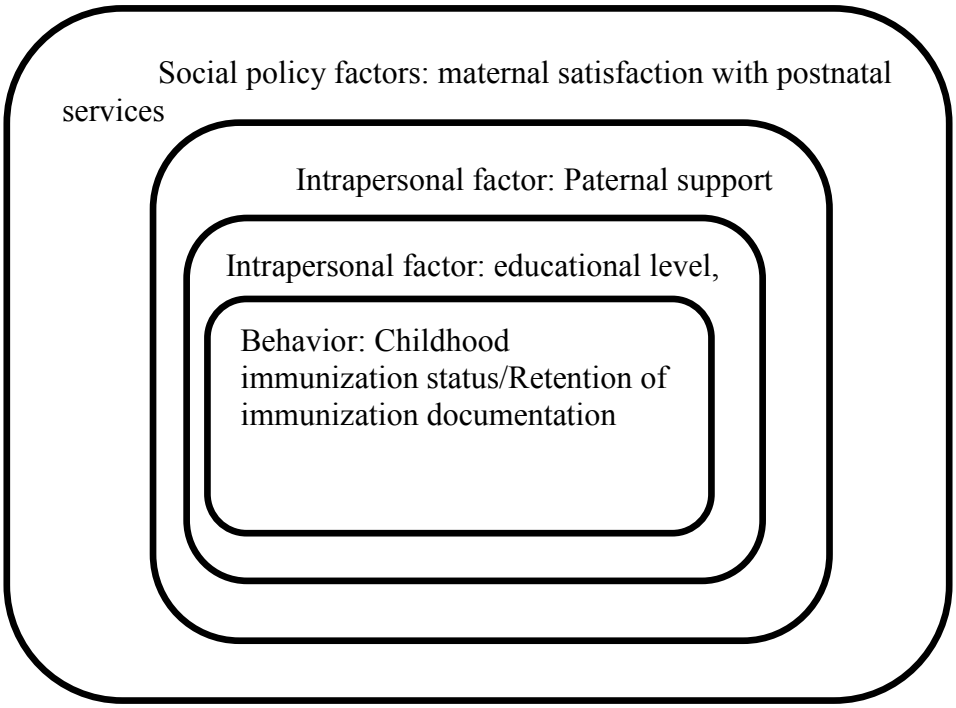

Figure 1. Pictorial representation of social ecological basis of predictors of full childhood immunization status Adapted from "The social-ecological model: A framework for prevention" by Center for Disease Control and Prevention, 2009. Copyright 2009. Retrieved from http://www.cdc.gov/violenceprevention/overview/social-ecologicalmodel.html

Operational Definition of Terms

Full (complete) childhood immunization status is a situation where a child has received all expanded program on immunization recommended vaccinations and is indicated in immunization documentation (card) or maternal self-report. For instance: one dose of BCG vaccine; three doses each of oral polio vaccine, diphtheria, tetanus and pertussis vaccine; and hepatitis B vaccine; one dose each of measles and yellow fever vaccine (NPC & ICFM, 2009).

Full (complete) childhood immunization rate is the ratio expressed in percentage between the number of children who received full immunization and the target population as defined by the expanded program on immunization within a given period. A child at the age of 12 to 23 months would have received full (complete) doses of the EPI recommended vaccines.

Immunization documentation is a personal record of immunization activities indicating the vaccinations administered with dates and other personal information issued to the recipient, by the staff responsible for the immunization.

Immunization documentation retention rate is the ratio expressed in percentage between the number of vaccination documents made available during the survey and the number of survey participants.

Maternal age is the chronological time in years the mother has lived on earth since birth.

Maternal education level is the extent of formal education the mother has acquired

Maternal knowledge of the importance of immunization documentation is the ability of the mother to respond accurately to questions that test what she knows about the importance of immunization documentation.

Maternal satisfaction with postnatal services is the mother's conclusion on how her experiences with the postnatal services align with her expectations.

Paternal support is maternal oral attestation of the husband or child's father encouragement and positive disposition towards childhood immunization.

Assumptions

In this study, I made the following assumptions: that the study is a cross-sectional survey of mothers of children between the ages 12 and 23 months old in Owerri, Imo state, Nigeria, childhood vaccination is a strategy to enhance a child's survival, vaccination history, and vaccination documentation gave an authentic history of vaccination status, the 2008 National Demographic and Health Survey recorded full childhood immunization coverage rate for south-east geopolitical zone of Nigeria was applicable to Owerri, at the age of 12 to 23 months, a child is expected to have received full (complete) doses of routine childhood immunizations, EPI 30-cluster sampling technique yielded a representative sample of the population, the population estimate used for cluster sampling is accurate and correct.

Limitations

In this study, the following limitations were expected: this is a cross-sectional study of mothers, only individuals that met the study inclusion criteria and were present in the community as at the time of the survey were included in the sample; cross-sectional survey cannot establish temporal sequence between some predictor variables and outcome variables, information recall bias may arise due to the use of self-reported testimony to ascertain vaccination history.

Delimitation and Scope of Study

In this study, I assessed two dependent variables (full childhood immunization status, and the maternal retention of immunization documentation). For full childhood immunization status, the independent variables of interest were paternal support and maternal satisfaction with postnatal services. While maternal personal factors such as maternal age, maternal education, and maternal knowledge of the importance of immunization documentation were independent variables for the maternal retention of immunization documentation.

The delimitations in the study were:

It was delimited to quantitative cross-sectional survey design. The study was delimited with geographic area of Owerri, paternal support, maternal satisfaction with postnatal services, maternal age, maternal education and maternal knowledge of the importance of immunization documentation.

The study was delimited to the mother who reported having a child whose age was between 12 and 23 months at the time of information gathering.

Significance and Implication for Social Change

The significance of the study was that the benefit of a high vaccination coverage rate in reducing morbidity, mortality and disability cannot be overemphasized (Hall & Jolly, 2011; Campbell, Borrow, Salisbury, & Miller, 2009; Goldhaber-Fiebert, Lipsitch, Mahal, Zaslavsky, & Salomon, 2012). Unfortunately, Nigeria remains one of the ten countries with childhood immunization coverage rate less than 50% and one of the six countries that contribute 50% of 10.8 million child deaths in the world (Antai, 2009). With over 160 million highly mobile people, Nigeria may continue to be a source of childhood infection in the world if her childhood vaccination coverage rate remains very low. Reasons for poor immunization status in Nigeria are not fully understood (Abdulraheem et al., 2011). This study was to fill the knowledge gap on factors that influence full childhood immunization status, and the maternal retention of immunization documentation in Owerri, Nigeria.

Positive social change implication of the study rest on the fact that its findings may generate the understanding of immunization factors that can influence childhood immunization (vaccination) status, and maternal system factors that may affect the maternal retention of immunization documentation (Weiss, Winch, & Bumham, 2009). The understanding could enable the doctors, and public health nurses articulate factors

that will be effectively focused to improve childhood immunization coverage rate. The doctors and public health nurses will understand the segment of mothers that may require special attention to improving the maternal retention of immunization documentation. Finally, the findings may cause improvement in the community need for immunization and increase immunization coverage rate, which will consequently reduce childhood morbidity, mortality, and disability burden (WHO, 2013).

Summary

One of the most efficient and cost effective public health interventions is immunization. Universal childhood immunization is WHO's initiative for its member countries which prevents about three million deaths annually (WHO, & UNICEF, 2013). In Nigeria, childhood immunization program has consistently performed below national and international targets since its inception 1979, with full childhood immunization rate being 23% on the average (NPC & ICFM, 2009; Antai, 2009; WHO, 2013). Consequently, Nigeria has one of the worst mortality rates among children under the age of five years. Maternal retention of immunization (vaccination) documentation is also poor (about 56%; Odusanya et al., 2008).

This study was a quantitative cross-sectional survey in which I assessed the association between multilevel influences of paternal support, maternal satisfaction with postnatal services, and full childhood immunization status. I also examined the association between the maternal retention of immunization documentation and maternal

education, age, and knowledge of the importance of immunization documentation. Knowledge from the study may cause positive change by improving public demand for immunization services and reducing the mortality rate among children (WHO, 2013).

Existing scientific literature on immunization programs and factors influencing childhood immunization status are discussed in Chapter 2. In Chapter 2, I explore the theoretical base of the study. In Chapter 3 and Chapter 4, I present methods of answering research questions and findings of the study respectively. Chapter 5 is dedicated to the discussion of the finding, its implications and limitations.

Chapter 2: Literature Review

Introduction

Vaccine-preventable diseases; measles, tetanus, yellow fever, Hepatitis B, diphtheria, pertussis, poliomyelitis, and tuberculosis among others had been causes of 40% mortality (which amounted to 400,000 in 2012) among children under the age of five years (National Primary Health Care Development Agency [NPHCDA], 2013). Expanded program on immunization (EPI) is a global childhood and maternal immunization project. WHO introduced this program to address the adverse effects of vaccine-preventable diseases globally.

WHO, UNICEF, and the Bill & Melinda Gates Foundation, as well as many other funding partners, have shown great commitment to this initiative (Singh, 2013). Even the Governments and people all over the WHO member countries are injecting many resources to actualize the objectives of EPI. However, despite these efforts, immunization coverage and maternal immunization documentation retention in Nigeria are far below expectation (Abdulraheem et al., 2011; Antai, 2009; CDC, 2012b; Odusanya et al., 2008). Nigeria is among the few countries where several of the world's neonatal tetanus deaths occur and is yet to reach neonatal tetanus elimination status (Singh, Pallikadvath, Ogollah, & Stone, 2012). The irony of the situation is that this country is highly predisposed to these diseases due to her peculiar epidemiological

situations, poor public infrastructural development, poor socio-economic conditions and poor resources for health (Alhassan et al., 2013).

Causes of poor childhood immunization status are not well understood (Abdulraheem et al., 2011; Odusanya et al., 2008). Studies have observed the impact of maternal, sociodemographic, and some system factors on maternal and childhood immunization (Khowaja et al., 2012; Odusanya et al., 2008; UNICEF, 2008). Literature is scarce on the influence of system factor such as maternal satisfaction with the postnatal services, and paternal support on full childhood immunization. Gaps still exist in the literature on factors that affect the maternal retention of immunization documentation. In this study, therefore, I assessed whether maternal satisfaction with postnatal services and paternal support have association with childhood immunization status. It also determined the association between maternal factors and the maternal retention of immunization documentation.

I begin this literature review by introducing the vaccinology and EPI, indicating that Nigeria has low immunization coverage despite efforts to implement EPI. I discuss literatures of full immunization, reviewed literatures on related methodological approaches and rationale for the study variables. Lastly, I discuss studies on key variables and critiqued the current research methods.

Literature Search Strategy

I searched databases, which included, but were not limited to the following, CINAHL PLUS, Pub Med, ProQuest, JAMA, Science index, MEDLINE, SAGE journal online, BioMedicalCentral journals, WHO, CDC and Nigerian government agencies' official websites. I used the following search terms as keywords: *immunization, childhood immunization, vaccination, childhood vaccination, vaccines, vaccine history and timeline, vaccine efficacy, and BCG vaccine efficacy.* Other search terms were *yellow fever vaccine efficacy, Measles-containing vaccine efficacy, DTP vaccine efficacy, Hepatitis B vaccine efficacy, poliomyelitis vaccine efficacy,* and *vaccine adverse effects.* Additional search terms were: *childhood immunization coverage survey, immunization and immunization client satisfaction, health service and patient satisfaction, maternal and childhood immunization and paternal support.* Again, I searched *maternal and child health and father's support, maternal characteristics and personal immunization documentation retention, and maternal characteristics and health services utilization,* and *immunization in Nigeria.* Final, I searched book chapters on vaccines and vaccine-preventable diseases. These produced information such as the history of vaccine, global and national universal childhood immunization efforts, and progress. Moreover, I was able to access peer review research articles which formed the theoretical foundation for this study. Research materials for this study were published between 1996 and 2013.

Theoretical Model

The social ecological model is the theoretical model that underpins this study. The social ecological model stressed the interactions between humans and their social and physical environment (CDC, 2009; Li, & Rukavina, 2012). The model originated from Urie Brofenbrenner ecological model (Golden, & Earp, 2012; Winch, 2012). Urie Brofenbrenner conceptualized five environmental systems that control human development as micro, meso, exo, macro and chrono, with micro meaning the part of the environmental systems in which humans interact very closely (Sallis et al., 2008; Yingst, 2011).

McLeory in describing human behavior in relation to health refashioned this ecological model to five levels of impacts (comprising individual, relationship, organization, community, and social policy) that modified performance and gave rise to social ecological model (Golden, & Earp, 2012; Winch, 2012). The model amplified the complex interplay of these multi-level influences on human behavior and affirmed the complexity and multidimensional factors of human social and physical environment (Li, & Rukavina, 2012; Winch, 2012). Within the model individual factors or intrapersonal factors are age, education and knowledge, social class, self-efficacy, height, weight, belief (Li, & Rukavina, 2012; Winch, 2012). Relationship/interpersonal factors are peer groups, family members, professional colleagues, partners, and other forms of relationships while organizational factors are churches, schools, and community

organizations (Li, & Rukavina, 2012; Winch, 2012). Baral et al. (2013) described community capital creation, organization, and provision of services within the peculiarity of personal, family, and community circumstances as community factors. Laws, rules and policies defining responsibilities, education and training, housing, health and other social sectors are social policy (Baral et al., 2013; Li & Rukavina, 2012; Winch, 2012).

There is evolving perspective that health issues and interventions are better approached by targeting multilevel factors (Golden & Earp, 2012). Consequently, here I assessed the association between full childhood immunization status, (health behavior) and paternal support (interpersonal), and maternal satisfaction with the postnatal services (social policy factor). Also, I examined the association between the maternal retention of immunization documentation (health behavior) and maternal age, education and knowledge of the importance of immunization documentation (personal factors).

Childhood Vaccine-Preventable Diseases and Vulnerability

Diphtheria is a disease affecting the mucous membrane of the respiratory tract with air passage blockage and myocarditis as complications (Tiwari & Clement, 2008). Corynobacterium diphtheria is the causative agent. Children before the age of 15 years are the most vulnerable group, and the mode of transmission is through contact with a case or carrier of the disease (Tiwari & Clement, 2008). Vaccination with diphtheria toxoid-triple antigen vaccine containing diphtheria, tetanus, and pertussis antigen prevents diphtheria (WHO, 2013a).

The etiologic agent of hepatitis B is a hapadnavirus. Acute hepatitis B leads to jaundice while chronic hepatitis B infection leads to hepatocellular carcinoma and liver cirrhosis (Nelson & Thomas, 2007). The hepatitis B prevalence rate can be up to 8% in a highly endemic area with 50% of the disease occurring before the age of 5 years (Klevens, Lavanchy, & Spalding, 2008). Klevens et al. also indicated that 90% of childhood infection leads to chronic infection, which is responsible for the development of primary hepatocellular carcinoma and liver cirrhosis. Hepatitis B is a blood-borne infection, spreading through parenteral, sexual, and perinatal exposures. Administration of hepatitis B vaccine can prevent hepatitis B infection for 10 years and WHO recommend's three doses of hepatitis B (HEB) vaccine as part of routine childhood vaccine (Klevens et al., 2008; Nelson, & Thomas, 2007).

Measles is an acute viral infection, whose susceptibility and complications are more among very young children than the larger population (Orensten, Papania, & Strebel, 2008). Pneumonia, blindness, laryngotracheobronchitis, and encephalitis are among the common complications of measles, with case fatality rate of about 30% (Strebel & Hersh, 2008). Measles virus is the measles etiological agent, and it spreads through airborne droplet and contact with infected persons' respiratory discharges. Measles containing vaccine prevents measles. A bacterium, Bordetella pertussis, causes pertussis, an acute respiratory disease, marked with violent and irritating cough that ends with a characteristic whooping sound and sometimes post-tussive vomiting. Pneumonia,

encephalitis, and hypoxia are its complications with severity higher among younger children (Cortese, & Bisgrad, 2008; Duclose, & Helperin, 2008). The disease is spread through droplet or contact with discharges of an infected person. WHO recommends whole cell (wp) pertussis vaccination for pertussis prevention, and it is one of the vaccines for the routine childhood immunization (Cortese & Bisgrad, 2008).

Poliomyelitis is an acute infection affecting mainly children. Polio virus is its causative agent. Poliomyelitis infection spreads through fecal-oral transmission via contaminated hand, food, water, and inanimate substances. Poliomyelitis presents a fever, headache with acute flaccid paralysis (AFP) as its complication (Aylward, 2008). Since the elimination of poliovirus serotype 2, bivalent oral polio vaccine is now applied for the prevention of poliomyelitis (Sutter, & Chochi, 2008). Tetanus is an acute disease of the exotoxin of clostridium tetani, which manifests in generalized spasm, and painful contraction of the muscles. Case fatality rate is more than 80% (Joyce & Vandelaer, 2008). Soil and feces contaminated wounds aid tetanus transmission. Non-hygienic cutting and dressing of the umbilical cord and umbilical stump of the newborn transmits neonatal tetanus (Kretsinger, Moran, & Roper, 2008). Routine childhood tetanus toxoid vaccination prevents tetanus (Kretsinger et al., 2008).

Tuberculosis is a chronic respiratory disease and mycobacterium complex is its causative agent. It clinically presents cough, fever, loss of weight and appetite, with miliary tuberculosis, and the meningitis tuberculosis as more dangerous consequences

(Hornick, 2008). Globally, tuberculosis attacked 8.6 million people and killed 1.3 million with 530,000 new cases among a 0 to 14 years old cohort in 2012 (WHO, 2013b). WHO recommends the administration of Bacillie Calmette Guerin (BCG) immunization to the newborn for the prevention of dangerous consequences of tuberculosis (Buff, & Raviglione, 2008; Singhal et al., 2011). Yellow fever virus causes yellow fever, and the bites of Aedes mosquitoes spread it. Its symptoms are fever and jaundice leading to the liver and kidney injuries with case fatality rate between 20% and 60% (Nelson, 2007). Routine childhood yellow fever vaccination at the age of 6 months prevents the disease (Steples, Roth, & Shope, 2008).

Vaccines and Expanded Program on Immunization

Vaccines for Childhood Diseases

Vaccine is a biological product which can induce protective immune response on a susceptible person administered with the product (Loughlin & Strathdee, 2007). Vaccination or immunization is the act of administering this vaccine. There are five types of vaccines in EPI initiative. They are attenuated live antigen: Bacille Calmette Guerin (BCG), yellow fever, measles and oral polio vaccines; inactivated "killed" vaccines: inactivated polio vaccine; toxoid: tetanus toxoid and diphtheria toxoid; subunit vaccines: pertussis vaccine; and recombinant vaccines: Hepatitis B vaccine (Loughlin & Strathdee, 2007).

History of vaccines. The practice of immunization would have originated from Buddhist Clergyman (Henderson, 1997), but publicized history of vaccine dated from Edward Jenner's experiment in 1796. Jenner inoculated cowpox into the skin of a boy to protect him against smallpox (Henderson, 1997). CDC (2006) stated the dates of licensing the following vaccines:

Inactivated polio-vaccines -1995;

Trivalent oral polio vaccine -1963;

Measles, mumps, rubella vaccine -1971;

1982 for hepatitis B vaccine, which had been recommended for infants since 1991.

A vaccine is licensed before public use.

Vaccines' protective potential. A vaccine's ability to elicit adequate immune response (develop sufficient antibodies) to prevent the target disease determines its protective potential. At the community level, it is determined by vaccine effectiveness and vaccine efficacy. Vaccine efficacy is the rate of reduction in disease burden between the vaccinated and unvaccinated segment while vaccine effectiveness is a measure of the capability of vaccine to offer protection against the disease in the population (Weinberg, & Szilangvi, 2010).

Pereira et al. (2012), in a randomized control trial in Brazil, concluded that BCG has 25% effectiveness and vaccination of 381 children can prevent at least one case of

tuberculosis and is cheaper than treating a case of tuberculosis. BCG is partly protective against tuberculosis, but prevents more serious consequences of infection such as tuberculosis meningitis, and miliary tuberculosis (Favorov et al., 2012; Singhal et al., 2011). After 1 month interval of full DTP administration, percentage of recipients that developed protective level antibodies is 100% for tetanus, ≥ 99%, ≥ 88% for diphtheria and pertussis respectively (Kostap-Petraco, 2013; McCormack, 2012). A dose of 17D strains of yellow fever vaccine confers protective level of antibodies to 91-100% of its recipients (Thomas, Lorenzetti, Spragins, Jackson, & Williamson, 2012).

Evaluating measles vaccine among children vaccinated with measles virus containing vaccine, Borras et al. (2012) observed that while 73.3% of children of nine months old developed protective level of antibody, 100% of children between the ages of 13 and 14 months old developed the same level. Researchers in Iraq documented 93.6%, 100% protective levels of antibodies among women vaccinated with one doses and two doses of maternal tetanus toxoid vaccines respectively (Hurmez et al., 2012). Clinical effectiveness of bivalent OPV is 23.4% (O'Reilly et al., 2012). CDC (2012b) evaluated the efficacy of hepatitis B vaccine and rated the efficacy at 95%. These studies above have scientifically demonstrated reasonable protective potential of these EPI vaccines. The level of protective tendency accounts for the success stories in countries where immunization coverage is high.

Adverse effects of EPI vaccines. Vaccination can sometimes induce unexpected experience on individuals. Adverse effect can also be called reactogenicity. A study explored the common experiences on vaccines' side effects in Uganda, and discovered that caregivers experience pain, fever, rashes and restlessness often among the vaccinated children (Braka et al., 2012). Adverse effects are local reactions and systemic reactions. Local reactions are vaccine adverse effects experienced around the site of injection and in DTP vaccine can be swelling, redness and pains (McCormack, 2012).

When reaction extends to other body systems, it is termed systemic and is marked with headache, fever, fatigue and gastro-intestine involvement for DTP vaccine (McCormack, 2012). Pereira et al. (2012) posited that BCG vaccine has very rare adverse effect. BCG vaccination can cause one case of lymphadenitis and minor ulcer in 11,980 recipients (Pereira et al., 2012). Minor fever and respiratory symptom can occur after yellow fever immunization, in very rare occasion neurologic effect as encephalitis has been reported (Thomas et al., 2012). Administration of measles-mumps-rubella vaccine can lead to fever, rashes, and rare inflammation of the lymph nodes (Svanstrom, Callreus, & Hviid, 2010).

Parents must have authentic and accurate information about side effects of vaccines and benefit of the vaccine so that sound knowledge will instruct vaccination decision. Also, parents should be educated on the laws that will enable them seek redress in the event of vaccine-induced adverse reaction. Adequate parental information is the

only way to reduce the negative influence of anti-vaccination movement on childhood immunization status.

Expanded Program on Immunization

WHO launched EPI in 1974 to increase the chances of survival for children under the age of five years in the world (CDC, 2012a). The success of the world smallpox eradication project from 1967 to 1977 (Oyo-Ita et al., 2012) and the obvious potential of immunization as a very potent public health intervention gave impetus to this project. The project in Nigeria initially covered childhood immunizations against six childhood vaccine-preventable diseases (diphtheria, measles, pertussis, poliomyelitis, tetanus and tuberculosis), and in 2004, Hepatitis B and yellow fever immunizations were included (Abdulraheem et al., 2011).

EPI objectives are to achieve not less than 90% national immunization coverage and 80% coverage at district levels, global eradication of poliomyelitis, elimination of neonatal tetanus, and drastic reduction of measles incidence (WHO, 1996). To actualize these objectives, the WHO and UNICEF jointly established Global Immunization Strategy (GIVS). WHO and UNICEF provide encouragement, technical support, and funds to all member nations for the implementation of EPI. In Nigeria, EPI was launched in 1979 and relaunched in 1984 (Antai, 2009).

Immunization schedule. Immunization schedule is a plan of action indicating the age and the appropriate interval of administration for each dose of the required

immunizations for children and women. The schedule ensures that a child or a woman of childbearing age receives all prescribed immunization at the appropriate age. Larson, Cooper, Eskola, Katz, and Ratzan (2011) stated that 29 different immunization schedules exist globally. EPI schedule of any country depends on her unique epidemiologic characteristics (such as the risk of infection, development of specific defense against the disease by a child, when child's acquired passive antibodies will no longer interfere with seroconversion), the operational, and financial capability of the country (Larson et al., 2011).

However, WHO recommended childhood immunization schedule for some developing countries is one dose of BCG vaccine and the first dose of hepatitis B vaccine at birth; three doses each of diphtheria-tetanus-pertussis vaccine, and oral polio/inactivated polio vaccine. Other recommended vaccines are hemophillus influenza vaccine at the age of 6 weeks-10 weeks-14 weeks; administration of the second and third doses of hepatitis B vaccine are at the age of 10 week and 14 weeks respectively. Finally, yellow fever vaccine at the age of 6 months; while measles virus containing vaccine at 9 months old (Burton et al., 2009).

Similarly, WHO launched a project for the elimination of neonatal tetanus in the world by the year 1995 (Roper, Vandelaer, & Gasse, 2007). Ten years later WHO launched another program to eliminate maternal tetanus (Roper et al., 2007). For these initiatives, maternal tetanus toxoid immunization is the main thrust (Munoz, 2013). WHO

recommended five doses of tetanus toxoid for lifelong protection of mothers and their babies. First two doses at one month interval should be given during the first pregnancy, the remaining three administered at every subsequent pregnancy or yearly intervals (Munoz, 2013).

Implementing EPI. Routine immunization and or supplementary immunization exercises are measures of implementing EPI in countries including Nigeria. Routine immunization is an organized system of immunization at agreed fixed location and period or through mobile facilities. Supplementary immunization activity is organized mass immunization campaign made to increase immunization coverage in a given community, which in most of the times is administered through the house to house mechanism (Fitzpatrick & Bauch, 2011). Rani, Yang, and Nesbit (2009) opined that the routine immunization is an indispensable means of achieving universal vaccination, pointing that supplementary immunization activity can be used only to increase coverage among the underserved communities. A study in Uganda indicated that the caregivers dislike supplementary immunization and prefer routine immunization exercise, because of the forceful nature of supplementary immunization exercise which sometimes raised the suspicion of the caregivers (Braka et al., 2012).

EPI was launched globally by the WHO in 1974 to increase the chances of child survival. WHO strongly encourages its member countries to adopt and implement this program in their respective country. The immunization project started in Nigeria around

1956, but Nigeria joined other WHO member nations to launch expanded program on immunization in 1979 (Antai, 2009; WHO, 2012). The EPI program as a health service is in the concurrent legislative list of the Nigerian constitution; hence it enjoys decentralization among the three tiers of government-federal, state, and local government (Wonodi et al., 2012). The federal government funds the procurement of vaccines, and formulates and circulates immunization guidelines with its international funding partners (Wonodi et al., 2012). Similarly, the 36 states and 774 local government councils fund the program's implementation and logistic requirements in their respective areas (Wonodi et al., 2012). Three local government councils are in Owerri in Imo State, southeast of Nigeria.

Under EPI program, before each child's first birthday, they are expected to have received one dose of BCG vaccine at birth, three doses each of DTP_w vaccine, HEB vaccine, OPV vaccine at the ages of 6, 10 and 14 weeks respectively (NPC & ICFM, 2009). Other recommended immunizations are one dose each of measles vaccine and yellow fever vaccine at six months and nine months old respectively (NPC & ICFM, 2009). A mother would have at least received two doses of tetanus toxoid vaccination (NPC & ICFM, 2009; WHO, & UNICEF, 2013). Routine immunizations in both static and mobile facilities are used to implement the program. Supplementary immunization activities are also carried out from time to time, mainly with regards to polio and measles vaccinations in accordance to the immunization schedule (NPC & ICFM, 2009). High

immunization coverage rate will reduce mortality among children under the age of 5 years, leading to the realization of MDG objective number four and creating $17 billion economic growths within 10 years in Nigeria (Wonodi et al., 2013).

EPI performance. The computation of immunization coverage rate, seroprevalence, morbidity, and mortality rates of target diseases aids the EPI performance monitoring. Immunization coverage rate survey is a process evaluation mechanism while seroprevalence survey measures the quality of the immunization program (Ang et al., 2013). CDC (2012a) and Rani et al. (2009) defined immunization coverage rate as the ratio expressed in percentage between the number of individuals who received immunization and the total reference group. Seroprevalence rate and immunization coverage rate are also indices of immunization status of individuals in the community and indicators of program effectiveness in influencing herd immunity (Ang et al., 2013). Seroprevalence is the ratio of the target population with protective antibodies against a particular disease expressed in percentage.

Diphtheria-tetanus-pertussis antigens called triple antigens coverage rates are EPI performance indicator (CDC, 2012b). Consequently, WHO and UNICEF estimated 83% of the world's children had full DTP immunization in 2012 (WHO & UNICEF, 2013). CDC observed that 22.4 million children of the world, out of which more than half live in India, Nigeria, and Indonesia were yet to be completely immunized against diphtheria-tetanus-pertussis in 2011 (CDC, 2012a). Nigeria is among countries of the world were

full immunization coverage rate is below 50% (Antai, 2009; NPC & ICFM, 2009). Again, Nigeria and India contribute most of the world's neonatal tetanus induced 130,000 newborn deaths (Singh, Pallikadavath, et al., 2012), due to poor maternal tetanus immunization coverage.

Surprisingly, Nigeria is one of the 10 countries where over 70% of the world's children without full DTP vaccination are living (WHO & UNICEF, 2013). On average in Nigeria, only 23% of children aged between 12 and 23 months had received complete EPI vaccination doses and 19% received none at all (NPC & ICFM, 2009). In the southeastern zone of Nigeria, where Owerri is located complete EPI coverage rate among ages 12 to 23 months was 43%, with 17% of them not vaccinated (NPC & ICFM, 2009). Nigeria's inability to leverage the EPI initiative might account for the high under five years of age mortality rate (157 per 1,000 live birth; NPC & ICFM, 2009).

Review of Literature with Similar Construct and Methodology

Oyo-Ita et al. (2012) studied the impact of Shell Petroleum Development Corporation's (SPDC) assistance in the performance of EPI, determined full immunization coverage and factors responsible for full childhood immunization status in six of the Nigerian Niger Delta states. The researchers applied multi-stage sampling method to select 2,432 children between the ages of 12 and 23 months. WHO/EPI-30 cluster survey form was adapted for data collection. Full immunization coverage among the participants was 68.5% (1,668/2,432), and the main predictor of full childhood

immunization was the proximity of the immunization facility to the household (Oyo-Ita et al., 2012).

The implication here is that spatial constraint is a major issue in the utilization of immunization facilities and decentralization of the facilities may give a helping hand. Proximity to the immunization center has been seen to associate with full immunization in other studies (Abdulraheem et al., 2011; Bagonza, Rutebemberwa, Mugaga, Tumuhamye, & Makumbi, 2013). Proximity to immunization centers can reduce the effort, time and money that will be expended in reaching the facility by patients. Proximity to a facility can increase knowledge of the immunization program since household near the facility will have greater chances of witnessing activities surrounding the program and probably ask questions and get informed. The study was a cross-sectional survey and may not be able to establish a cause-effect relationship.

UNICEF applied similar cross-sectional research design to determine immunization coverage for 12 to 23 months old children and their mothers, and vitamin A service utilization with smaller samples of 280 in Somaliland (UNICEF, 2008). The study determined sample size, and employed sampling technique in accordance with WHO established procedure for immunization coverage survey. That is the sampling size was determined using 95% confidence interval, level of precision expected ±10%, and assumed routine coverage of 35% (UNICEF, 2008). Sampling technique used here was WHO/EPI cluster sampling. The sampling method is a two-stage probability

sampling in which cluster is the primary sampling unit (UNICEF, 2008). Full childhood immunization coverage was 25.8% (72/280); card retention was 19% (53/280), and full immunization is higher among the urban communities than the rural communities (UNICEF, 2008). Maternal education was not a determinant of immunization status (UNICEF, 2008).

Invalid immunization, card retention, and vaccination drop-out rate are immunization program quality indices (UNICEF, 2008). Dropout rate is used to monitor program continuity and follow-up process. Full maternal tetanus coverage (having at least two doses of TT) was 30.4% (95/280) with immunization documentation retention of 11.2% (31/280; UNICEF, 2008). Utilization of antenatal facilities is predictor of maternal tetanus immunization status (UNICEF, 2008). The Somaliland study has shown an association between full maternal and childhood immunization with urban or rural location, and utilization of antenatal facilities. The above finding is consistent with another finding in Ethiopia, that associates complete childhood immunization with utilization of antenatal clinics (Etana & Deressa, 2012), and that full immunization occurs more in urban than rural areas (Singh, 2013). Mothers receive information concerning childhood immunization during antenatal clinic sessions, so those in attendance would have opportunities to acquire useful immunization information that will ensure full childhood and maternal immunization status.

Urban areas are at advantageous position in terms of public infrastructures including immunization facilities and human resources (Sahu, Pradhan, Jayachandran, & Khan, 2009). An urban area has more people in the high socio-economic class than the rural area, and this has a positive effect on utilization of health facilities including immunization in developing countries.

Maternal education has been found not associated with full childhood immunization (UNICEF, 2008). However, this finding is contrary to researches in developing countries (Nigeria and India) where a mother's education level positively affect immunization status and utilization of public health services (Abdulraheem et al., 2011; Odusanya et al., 2008; Singh, Rai, & Singh, 2012).

The difference might be that because maternal education was very poor in Somaliland, the impact of the small group of educated mothers made no noticeable difference. The study design is across-sectional survey, which is generalizable, but the accuracy of the population data may influence result (UNICEF, 2008).

In Awe Local Government Area, Nassarawa state, Nigeria, Abdulraheem et al. (2011) used cross-sectional survey to investigate factors responsible for missing an immunization opportunity and partial immunization among children less than one year old. Researchers sampled clusters first sand within selected clusters, 658 participants were selected through simple random sampling (Abdulraheem et al., 2011). A Chi-square test statistic analyzed the difference between factors in complete and incomplete

immunization groups (Abdulraheem et al., 2011). Full childhood immunization coverage was 37.2% (245 of 658), and respondents attributed their incomplete vaccinations to the following reasons in order of magnitude: immunization safety, distance to the facility, not meeting any personnel in the immunization center, and lack of money (Abdulraheem et al., 2011).

Maternal knowledge of immunization importance, education, and occupation are significant predictors of full childhood immunization (Abdulraheem et al., 2011). Maternal age, gender of the child and marital status are not significantly associated with full childhood immunization (Abdulraheem et al., 2011). Over thirty-three percent (33.4% either 220 of 658) of the children had missed immunization chance and children with missed immunization have more chances of partial immunization than those without missed immunization opportunity (Abdulraheem et al., 2011). The study was a cross-sectional study, but researchers did not use WHO/ EPI standardized survey instrument.

Abdulraheem et al. (2011) observed that immunization safety concern, not meeting immunization personnel on scheduled immunization days, lack of money, maternal knowledge of the importance of the immunization, and occupation are associated with full childhood immunization. The above finding is similar to other studies, which observed that full childhood immunization status is associated with maternal knowledge of the importance of immunization and household income (Bagonza et al., 2013; Etana & Deressa, 2012). In analyzing the association between variables, a

Chi-square statistic was used to test the difference. This technique can only give understanding of crude association between variables. Dependent variables with many covariables demand a multivariate statistical technique for analysis.

Researchers in Edo state, Nigeria, assessed the impact of a corporate firm's (GSK Pharma) assisted EPI facilities in the area in terms of full childhood immunization coverage among children of age between 12 and 23 months and determined impact of maternal factors on full childhood immunization (Odusanya et al., 2008). The researchers adopted WHO standard EPI cluster survey design in determining sample size (339 mothers of children whose ages were between 12 and 23 months) and sampling technique (Odusanya et al., 2008). The data collection instrument was interviewer-administered questionnaire, with many of the questions close-ended (Odusanya et al., 2008).

Questions in five domains tested knowledge about childhood immunization. Odusanya et al (2008) stated that the questions are: "a Mentioning the appropriate age for the reception of measles vaccine with nine months old being the correct answer; b Reasons for childhood immunization, which is for the prevention of childhood vaccine-preventable diseases; c Correct number of times a child is expected to take oral polio vaccine, and three is the expected answer; d Mentioning of at least three symptoms of childhood vaccine-preventable diseases with symptoms like fever, skin rashes, difficulty in breathing, cough, paralysis, difficulty in swallowing, and muscular pains; e Stating the

expected age at which a child is required to have taken all the prescribed vaccines, and the correct answer is nine months". Responses within these expected answers were seen as correct and scaled "1" while those outside these or no response were seen as incorrect and classified "0". A minimum score of three points is classified as satisfactory (Odusanya et al., 2008).

Study findings showed that the full immunization coverage was 60% (203 of 339) with document retention of 55.5% (188/339; Odusanya et al., 2008). Maternal education, maternal knowledge of immunization importance, obtaining services from the facility supported by GSK, and maternal retention of immunization documentation (immunization card) are significantly associated with full childhood immunization (Odusanya et al., 2008). It is important to note that the instrument used to obtain information rated response in a binary scale of 1 for correct and 0 for wrong responses respectively. The study participants are of similar age group (12-23 month old children) with the UNICEF study mentioned earlier (UNICEF, 2008).

However, the outcome of the findings in the two studies differs as it concerns maternal education. Maternal education is associated with full immunization in Edo State, Nigeria in this study while it is not in Somaliland (UNICEF, 2008). There is an association between full immunization and utilization of GSK-Pharma assisted facility and the maternal retention of immunization card. GSK-Pharma assisted facility may not suffer from the poor state of physical facilities and supplies, which may be demoralizing

to staff and cause the staffs' failure to turn-up for duty regularly as frequently witnessed in government facilities. Workers irregular presence in the clinic is one of the situations for not being immunized (Abdulraheem et al., 2011). Assistance from a corporate firm (Shell Petroleum Cooperation) is associated with full childhood immunization in Niger Delta Region of Nigeria (Oyo-Ita et al., 2012). The result of a community-based survey like this is generalizable.

In Ambo Woreda, Ethiopia, Etana and Deressa (2012) determined full childhood immunization coverage for children between 12 and 23 months old and assessed factors that influence full childhood immunization (Etana & Deressa, 2012). Sample size determination and selection of participants adopted WHO/EPI 30-cluster sampling method. Trained data collectors used structured interviewer-administered questionnaire to collect data (Etana & Deressa, 2012). The dependent variable (childhood immunization status) was measured from the record on the vaccination card (immunization document) or oral history of vaccination from mother. The questionnaire also measured maternal knowledge of childhood immunization schedule, maternal knowledge of vaccine-preventable diseases, place of delivery, antenatal service utilization, reception of maternal tetanus immunization and maternal demographic characteristics as independent variables (Etana & Deressa, 2012). Binary univariate logistic regression analysis analyzed the crude association while multivariate logistic

regression analysis was employed to analyze the predictors of full childhood immunization status.

Full childhood vaccination coverage was 35.6% (191 of 356); crude association exists between full immunization and mother's level of education, place of abode and place of child delivery, but only child's place of delivery is significant adjusting for other covariables (Etana & Deressa, 2012). Full childhood immunization is significantly associated with maternal knowledge of immunization benefits, maternal knowledge of immunization schedule, and utilization of antenatal care (Etana & Deressa, 2012). Etana and Deressa (2012) observed that maternal place of residence and demographic characteristics are not significantly associated with full immunization. The finding on the impact of maternal place of residence differs from that of a prior study in Somaliland where maternal place of residence is significantly associated with full immunization (UNICEF, 2008).

Place of delivery of a child and maternal knowledge of immunization schedule each has an association with full childhood immunization (Etana & Deressa, 2012). Delivery in a health facility indicates that the mother had better chances of receiving immunization information. Immunization information for those with positive health care experiences in these facilities will create awareness and change in attitude and practice towards better immunization practices. The study result is related to the observation that there is an association between full childhood immunization status and utilization of

health facilities (Singh, Rai, et al., 2012). The study is generalizable since it is a community-based survey, but may not indicate causality.

Bagonza et al. (2013) conducted a cross-sectional descriptive study to determine yellow fever immunization coverage and reasons for not being immunized among residents between the ages of 9 months and more in Pader district, Uganda. WHO/EPI 30-cluster sampling method was used to select 680 respondents stratified by age (below five years, 5–14 years and 15 years and above). Data collection instrument was interviewer-administered WHO's EPI 30-cluster survey form (Bagonza et al., 2013). Yellow fever vaccination coverage is the dependent variable and is measured by card or oral evidence of yellow fever vaccination. The independent variables were demographic characteristics and reasons for not being vaccinated where applicable. Descriptive result was disaggregated by age and gender (Bagonza et al., 2013).

The prior study revealed that yellow fever immunization coverage was 96.17% (654 of 680), and the card retention was 51.6% (351of 680; Bagonza et al., 2013). The researchers observed that reasons for not participating in immunization are traveling outside the study area, lack of money for transportation to immunization center and illness during the vaccination period. Bagonza et al. (2013) observed that the illness during the time of mass immunization and lack of money for transportation are the reasons for not being immunized. Lack of money for transport might relate to family income, and proximity to the facility that other studies have shown to influence full

immunization (Abdulraheem et al., 2011; Vandermeulen et al., 2008;). The study is a descriptive cross-sectional study and tested no hypothesis between variables.

Vandermeulen et al. (2008) computed vaccination coverage rate, timeliness and socio-demographic determinants of vaccination among adolescents in Flanders, Belgium. This study focused three immunizations: meningococcus serogroup C, hepatitis B, and measles-mumps-rubella vaccine. The researchers conducted a cross-sectional study that employed WHO/EPI 30-cluster survey sampling technique to select 1,500 participants. Immunization documents were the only source of information on immunization status. Questionnaire was administered to collect data on demographic characteristics and reason for not being immunized, where applicable from the respondents. Univariate and multivariate logistic regression analysis analyzed data. Immunization coverage rate was 58.1%, (872 of 1500) retention of immunization documentation was 31.8% (477 of 1500; Vandermeulen et al., 2008). Father's full employment, maternal partial employment, parental education (not to university level), ethnicity (being Belgian or European) positively influence full immunization (Vandermeulen et al., 2008). Conversely, large family (> 4), father's partial or unemployment and single female parent negatively influence full immunization and divorce may be responsible for the loss of immunization documentation (Vandermeulen et al., 2008).

Parental education before a university level is associated with full immunization (Vandermeulen et al., 2008). The finding is consistent with a study in Canada which

indicated that parents with lesser education are more likely to have full immunization than parents with higher education (Dummer, Cui, Strang, & Paker, 2012). Maternal stress may increase with the number of children since mothers in this situation are caring for many children. Consequently, she may not find an appropriate time to take a child to immunization center for immunization. The implication of this study is the need to factor the marital status of the heads of household and socioeconomic factors in immunization planning for better program performance. The study is a cross- sectional survey, but immunization documentation (immunization card) only was the source of childhood immunization status data, and this will precipitate the exclusion of many eligible participants and may bias estimates.

Sanou et al.(2009) investigated factors associated with immunization status among children aged 12 to 23 months in Nouna Health District, Burkina Faso. The study was a cross-sectional design that involved 476 children aged 12to 23 months in Nouna Health District. Sampling probability proportional to population size was used to draw participants from the Health Research Center's Demographic System (DSS) Database (Sanou et al., 2009). Questionnaire was the primary source of data collection. Distance to immunization center was determined with global positioning system (GPS), and demographic information was collected from DSS database. Mothers shared information on immunization history and other immunization related data. Health facility records and

immunization cards provided data too. Researchers verified BCG scar. Chi-square test of association and multivariate logistic regression were the test statistics used.

The researchers found that complete immunization was 50.2% (239 of 476). Findings indicated that complete immunization is significantly associated with knowledge of immunization objectives, availability of vaccination card, parents' education, place of living, level of communication, place of birth, religion, and socio-economic condition (Sanou et al., 2009). In a multivariate logistic regression result, only availability of immunization card (*OR* = 2.381; 95% *CI* = 1.436, 3.948); communication complaint (*OR* = 0.46; 95% *CI*: = 0.283,3.948); household income (*OR* = 2.1; 95% *CI*: = 1.24,3.53); and religion (*OR* = 1.811; 95% *CI*: = 1.102,2.985) were significant.

The study outcome is similar to that of other studies in Nigeria and Ethiopia. These studies indicated association between complete childhood immunization and knowledge of immunization objectives, parent's education, good service provider's communication and availability of immunization documentation (Etana & Deressa, 2012; Odusanya et al., 2008).

Methodology Approaches

Cross-sectional design using secondary data arising from countries' Demographic / Family and Health Survey, National Immunization Survey and administrative/provider records are applied in immunization coverage researches. Other study methods are cross-sectional designs that employ community-based survey, randomized controlled trial

design, and cohort study design. Administrative data has been proved to be incorrect in some quarters (He et al., 2012; Murray et al., 2003), might not be representative of the index population and may suffer from inaccurate denominator, mostly when accurate census does not exist as in most resource-poor countries (Burton et al., 2009). Providers' data may lack the necessary socio-demographic information for assessing determinants of immunization status (Usman et al., 2010).

Singh (2013) applied three rounds of Indian National Family Health Survey [NFHS] (Indian version of Demographic and Health Survey [DHS]) to assess disparity in full childhood immunization with reference to the region, gender and urban-rural areas. Three rounds of NFHS conducted 1992-2006 were the sources of data (Singh, 2013). Dependent variable, full childhood immunization is as defined by the WHO for developing countries and was measured from NFHS data. Demographic information, which formed the independent variable, was obtained from NFHS data too (Singh, 2013). Chi-square statistic tested for the differences; binary logistic regression determined the net change in full childhood immunization in relation to each independent variable (Singh, 2013). Full childhood immunization coverage is unequal between states, for instance a state such as Pradesh had full childhood immunization coverage of less than 25% while Gao and Tamil Nadu had more than 80% (Singh, 2013).

Urban areas and male children are significantly higher in full childhood immunization coverage than their rural and female counterparts respectively (Singh,

2013). DHS data has been criticized for the use of maternal recall of immunization status, which may bias estimate (Usman et al., 2010), but it has been found to be a source of reliable data (Burton, 2009). However, it is deficient in some other information that may help better understanding of full childhood immunization (Singh, 2013).

Antai (2009) studied determinants of full childhood immunization by performing univariate and multivariate analysis on 2003 Nigerian National Demographic and Health Survey data. Some ethnic groups like Igbos and Yoruba, children living in certain geopolitical location like south-west are more likely to have full childhood immunization than the Hausa/Fulani ethnic group, and children living in other four geopolitical zones of the country respectively (Antai, 2009).

Dummer et al. (2012) determined completeness and timeliness of childhood immunization for children under the ages of two years old in Nova Scotia, Canada, using three sources of data in a cohort study. Data on immunization status of the 8,245 babies born in the area in the year 2006 was collected from the physician billing system and public health records. Socioeconomic and demographic information was collected from census data (Dummer et al., 2012). Selected cohort's guardians/caregivers completed telephone interview to validate the administrative data, and logistic regression analysis tested the association between immunization completeness and timeliness with the independent variables (Dummer et al., 2012). Segmented immunization completion rate was 49% (4040 of 8245)at the age of 12 months old, 40% (3298 of 8245) at the age of 18

months old, and 58% (or 4782 of 8245) at the age of 24 months old (Dummer et al., 2012). Facilities that combined both public health and family medicine services performed more immunization than facilities that rendered only public health or only family medicine. Complete childhood immunization is positively associated with lower socioeconomic status than higher socioeconomic status (Dummer et al., 2012).

The implication of this study is that the immunization status is influenced by varying factors depending on where the study applies (probably: developed or under-developed countries). It is also important to note that this study had to verify the accuracy of administrative data with a telephone survey, confirming one of the disadvantages of administrative data in immunization coverage study. Another area of concern here is the multiple sources of information used to measure the study variables because administrative data could not have provided the required demographic profiles for the study.

Smith et al. (2011) conducted a cross-sectional immunization coverage survey. The study examined the influence of parents' belief on vaccination and refusal or delay of childhood immunization on full childhood immunization coverage (Smith et al., 2011). Data on childhood immunization status, parental delay or refusal or none or both were collected from 2009 National Immunization Survey (NIS) data while data on parents belief were collected from parents/guardian according to health belief index domain (Smith et al., 2011). The difference was tested with the aid of statistical t-test.

Parents who refused or delayed immunization are less likely to believe in the safety and benefits of vaccines, which affects full immunization coverage negatively (Smith et al., 2011). The study shows an example of analytic cross-sectional study. This study is trailed by the limitation of the original NIS. The national survey, being a telephone survey may not capture data from homes without landline telephone (Smith et al., 2011).

Usman et al. (2010) determined factors relating to completion of DTP after taking the first immunization dose in Pakistan. The researchers conducted a cohort study of 373 mother-child pair participants. Participants were followed-up for 90 days on receiving the first dose of DTP immunization to note when they received the next two required doses to complete DTP immunizations (Usman et al., 2010). Both univariate and multivariate logistic regression analysis analyzed the data. High rate of completion of DTP doses is significantly associated with proximity to the facility, household income, and lower age at the time the child enters the immunization service system (Usman et al., 2010). Loss in fellow-up may be the constraint of this study.

Adeyinka, Oladimeji, Adeyinka, and Aimakhu (2009) conducted a descriptive cross-sectional survey at Igbora Oyo state, Nigeria. Their aim was to assess the attitude and awareness of immunization among mothers of children under the ages of five years. Thirty-five item questionnaires were completed by 503 participants. Full childhood immunization coverage was 76.9% (387 of 503); partial immunization was 22.4% (113 of

503) while no immunization rate was 0.7% (4 of 503; Adeyinka et al., 2009). Majority of mothers had positive disposition to immunization, and 65.7% (330 of 503) had immunization information from antenatal care facilities (Adeyinka et al., 2009). Family/cultural support, proximity to the facility and long waiting period at the immunization center influence full childhood immunization status (Adeyinka et al., 2009).

A descriptive cross-sectional survey was conducted in Al Mukalla district, Yemen to determine full immunization coverage for children between the ages of 12 months and 23 months, and determine reasons not immunized (Ba'amer, 2010). Two hundred and ten children were selected through WHO/EPI-30 cluster sampling technique (Ba'amer, 2010). The researcher used WHO/EPI-30 cluster survey form to collect data from the study participants. Full childhood vaccination (full childhood immunization) was 82.4% (173 of 210); partial immunization was 12.4% (26 of 210), 5.2% (11 of 210) of the children was not immunized while card retention rate was 66.7% (140 of 210; Ba'amer, 2010). Common reasons for not being immunized were lack of information and long distance to the immunization center (Ba'amer, 2010).

Al-Mukalla has reached WHO target of 80% coverage at district level, an achievement that is still illusive in many developing countries. However, it was also reported that Al-Mukalla is an urban area, which study has shown to be disproportionally favored in terms of immunization services than the rural area (Singh, 2013).

Community-based survey like this can be limited by the population estimate used for sample size determination; where administrative data is used instead of the official census, there is a high propensity for error (Ba'amer, 2010). Other limitations are inaccuracy of maternal recall of immunization history and inaccuracy of the vaccinator in recording immunization profile of the child (Ba'amer, 2010).

Researchers used a randomized controlled trial design to assess the impact of home based immunization education intervention among low-literacy mothers on full childhood immunization in Pakistan (Owais, Hanif, Siddqui, Agha, & Zaidi, 2011). The researchers randomized 357 mother-child pairs to the intervention group (179) and the control group (178). Trained health workers administered a designed home based education intervention on the intervention group and applied conventional education intervention on the control group. Full DTP and hepatitis immunization among the intervention group (72.1% or 129 of 179) at the end of four months is significantly higher than the full DTP and hepatitis immunization among the control group (51.7% or 92/178; Owais et al., 2011). Vaccination card retention rate for the intervention group was 81% (or 145 of 179) and for the control group it was 69.1% or (123 of 178). The study has once more emphasized the impact of maternal literacy/knowledge on full childhood immunization as other studies did (Etana & Deressa, 2012; Odusanya et al. 2008). This randomized controlled trial might have suffered from the loss in follow-up. Also, the fact

that the data collection instrument administrators and the participants were not blinded to the treatment may bias the result of the study.

Rationale for Study Variables

Dependent Variables

The study has two dependent variables: full childhood immunization status, and the maternal retention of immunization documentation. Full childhood immunization status describes a situation where a child has taken all the scheduled doses of immunizations (Singh, Rai, et al., 2012). This term is also known as complete immunization or up-to-date in all required immunizations (Dummer et al., 2012; Smith et al., 2011). In Nigeria, this is when a child has received one dose of BCG vaccine, three doses of diphtheria-pertussis-tetanus vaccines, and three doses each of oral polio and hepatitis B vaccines, one dose of measles vaccine and one dose of yellow fever vaccine (Odusanya et al., 2008). Full childhood immunization is an important variable (index) to measure immunization program performance. It is a process evaluation measure for immunization program (Rani et al., 2009). Full childhood immunization is necessary for a child to acquire required immunity against the eight deadly childhood vaccine-preventable diseases in Nigeria. Acquisition of full childhood immunization helps to raise the herd immunity against these diseases and reduce the outbreak of these diseases. Herd immunity is the protection against infection possessed by members of a given

community due to a high proportion of protected persons in the community (Oyo-Ita et al., 2012).

Every dose of the immunization is recorded into a personalized immunization documentation which is kept under the custody of the mother/caregiver by the immunization personnel who performed the procedure. The documentation is also referred to as immunization card, and this is a term used in most immunization studies (Bagonza et al., 2013; Uwemedimo, Findley, Andres, Irigoyen, & Stockwell, 2012).

Immunization documentation retention is a measure to evaluate the quality of the immunization program (UNICEF, 2008). The documentation enables the immunization staff and caregivers to know when full childhood immunization status is attained, determine the antigens that have been received, and those outstanding or due. Valid immunization is immunization received according to the approved immunization schedule (Murray et al., 2003; Oyo-Ita et al., 2012). Crude immunization is the immunization done without conforming to the immunization schedule (Murray et al., 2003).

When this document is not available, researchers are forced to determine childhood immunization status by history of immunization given by the mother/caregiver and this data collection method Usman et al. (2010) posited can bias the estimate. Most studies described this variable, but only few had taken time to analyze this variable with other variables despite its importance and the fact that its rate of retention had been very

poor among the general populations. Furthermore, studies in immunization coverage always refer to it and immunization information from the immunization documentation provides "Gold Standard" for assessing immunization level, coverage and validity of immunization (Dummer et al., 2012; Murray et al., 2003).

Independent Variables

Independent variables are maternal satisfaction with the postnatal services, paternal support, maternal age, maternal education level, and maternal knowledge of the importance of immunization documentation.

Patient satisfaction is becoming a topical issue in the health services sector (Otani, Waterman, Dunagan, & Ehinger, 2012), but researchers are yet to relate this variable to immunization program. Patient satisfaction can be defined as cognitive comparison of patients' health service experience with patient's expectation (Li, Yuan, Wu, Luan, & Hao, 2013). Paternal support is a social support given by the father of the baby. In most cultures like that of Nigeria, the fathers' decisions hold much weight or influence and cannot be easily discarded in most family decisions, immunization matters included. Previous studies had reported the influence of family/cultural support and paternal education to the utilization of immunization services (Adeyinka et al., 2009; Rammohan et al., 2012). Paternal support had been studied in other health programs including utilization of maternal and child health facilities, breastfeeding, child's physical

and behavioral development (Dashti, Scott, Edwards, & Al-Sughayer, 2010; Ploeg et al., 2013; Zhang & Fuller, 2012).

Maternal factors such as age, education, and knowledge of the benefit of health behavior have been studied by many researchers and found to affect utilization of health services and full immunization (Abuya, Onsomu, Kimani, & Moore, 2011; Singh, Rai, et al., 2012). In this study, it is hypothesized that maternal age, education and knowledge of the importance of immunization documentation could influence the maternal retention of immunization documentation (.Singh, Rai, et al., 2012).

Studies on the key Variables

Maternal Satisfaction and Full Childhood Immunization Status

Literature exists mainly on health care patients' satisfaction. Satisfaction is a system factor that could be used to evaluate the quality of health services, especially the postnatal services (Li et al., 2013). Satisfaction is influenced by the following healthcare experiences: environment and facility for immunization, provider-client communication, side effect of vaccine, attitude and rapidity of care by the staff (Bleich, Ozaltin, & Murray, 2009; Otani et al., 2012). Bleich et al. (2009) stated that the experience can explain 10.4% variation in satisfaction. Satisfaction was significantly associated with patient's co-operation with treatment regimen and not switching between medications and health care facilities (Barrett-Connor et al., 2012; Bleich et al., 2009; Otani et al., 2012).

Scientists employed a cross-sectional study at St Louis, Missouri to examine how severity of illness influences patient's satisfaction among discharged patients of the hospitals. The study also was on how patient's satisfaction relates with patients willingness to recommend the facility and evaluation of the overall quality of care (Otani et al., 2012). Thirty-two thousand, fifty-three participants were enrolled in the study that showed that perceived quality of professional care; admission process and condition of wards significantly influence willingness to recommend the facility positively (Otani et al., 2012). These independent variables (professional care, admission process and ward condition) relate with perceived quality of care positively (Otani et al., 2012). The study outcome is consistent with the study of 21 countries of the European Union, which indicated that rapidity of professional attention, condition of facility and patient-provider communications are among the determinants patient's satisfaction (Bleich et al., 2009). The study was a cross-sectional study that used participant's self-reported responses to gather data. Consequently, it may suffer from recall bias, and may not be able to indicate cause-effect relationship.

Barrett-Connor et al. (2012) investigated the treatment satisfaction, side effect and adherence to or alternating treatment among postmenopausal women suffering from osteoporosis. The researchers applied longitudinal cohort study of 5,015 women on osteoporosis treatment. The study had one year follow-up period during which treatment satisfaction questionnaire medication (TSQM) was the instrument of data collection.

Logistic regression model was used to analyze the association between osteoporosis treatment satisfaction and persistence/changing of treatment (Barrett-Connor et al., 2012).

Findings showed that participants who are satisfied with osteoporosis treatment are significantly more likely to comply with treatment regimen and will not switch between health care providers or facilities (Barrett-Connor et al., 2012). The study detected association between treatment satisfaction and reports of side effect. The study was a longitudinal study, and the result of the study may be negatively influenced by loss in follow-up. The study outcome is similar to an Ethiopian study that revealed that patient's satisfaction is significantly associated with adherence to treatment (Nzenega, Gacho, & Tafere, 2013).

A team of scientists applied randomized cross-over study to examine the adherence to treatment between two groups of postmenopausal women taking two different osteoporosis medications. In the study, 250 postmenopausal women were randomly allotted to one of the two treatment groups (one group received denosumab and the other received alendronate). The two groups were monitored for one year at six month's intervals. After one year, the groups alternated their treatments (Kendler et al., 2011). Patient's adherence to denosumab was higher than the adherence to alendronate (87.3% either 110 of 126 and 76.6% either 95 of 124 respectively; Kendler et al., 2011). Mean satisfaction index for denosumab group was significantly greater than means satisfaction index for alendronate group (p=.001). Participants were not blinded to

treatment, were those who agreed to participate in the two treatment regimens and were aware of the purpose of the study. This might have introduced bias and might be responsible for the high adherence rate observed among the participants.

Randomized trial takes place in a controlled environment and, therefore, can be very good in internal validity and poor in external validity. This study result is similar to the outcome of a later study of postmenopausal women on osteoporosis treatment. (Barrett-Connor et al., 2012). Evaluating factors relating to adherence to anti-hypertensive treatment, Zyoud et al. (2013) conducted a cross-sectional research design. In the study 410 hypertensive patients from public health facilities in Nablus district of Palestine were enrolled using convenience sampling method. Questionnaire was used to collect data on perceived satisfaction and medication adherence. Treatment satisfaction was significantly associated with adherence to anti-hypertensive medication. Study participants were drawn from the district only; consequently the study outcome cannot be generalized. Convenience sampling method was adopted in the selection of participants so the participant may not be representative of anti-hypertensive patients in the district. Finally as a cross-sectional study design, the study cannot infer causality. The finding has again shown the relationship between these two variables in the same manner the two studies on postmenopausal women did (Barrett-Connor et al., 2012; Kendler et al., 2011).

Huas et el. (2010) used another cross-sectional study to compare the healthcare providers' perceived adherence and patient's perceived adherence, and factors relating to

adherence. The researchers recruited 785 postmenopausal women undergoing osteoporosis treatment in France (Huas et al., 2010). Two sets of questionnaires were administered; while the investigators completed questionnaire on medical and clinical features, the participants completed a questionnaire on sociodemographic and behavioral features. There is significant difference between the healthcare providers rated adherence to osteoporosis treatment and the patient's perceived adherence (Huas et al., 2010).

The study is a cross-sectional study that can neither establish sequence of events nor cause-effect relationship. Also, data collection from oral testimonies of the participants may introduce recall bias to the investigation. The relationship between treatment satisfaction and treatment adherence in this study is again consistent with the other researches focusing on treatment adherence and satisfaction (Barrett-Connor et al., 2012; Kendler et al., 2011; Zyoud et al., 2013).

Tuberculosis treatment adherence and patient's satisfaction in Sidama zone, Ethiopia was investigated with a cross-sectional study design (Nezenega et al., 2013). Probability sampling method was employed to select 531 tuberculosis patients who responded to questions on treatment adherence and treatment satisfaction.

Tuberculosis treatment adherence was 26% (138 of 531) while patient's satisfaction was 90% (478 of 531). The association between patient satisfaction and tuberculosis treatment adherence was significant ($p < .05$;Nezenega et al., 2013). The study also observed that accessibility; patient-provider interaction, perceived level of

professional care, waiting time, perceived safety and the condition of the facilities drive patients' satisfaction.

Again this study results are consistent with the results of other researches on adherence to osteoporosis treatments and anti-hypertensive treatment (Barrett-Connor et al., 2012; Kendler et al., 2011; Otani et al., 2012). Factors that influence patients' satisfaction as observed in this study have been observed in other studies (Bleich et al., 2009; Otani et al., 2012). These studies have shown that health intervention procedures that demand continuous multiple applications for over a period are more likely to be affected with adherence related issues. Since full childhood immunization implies the administration of twelve doses of vaccines within nine months, it falls into this category, hence the compliance issue being experienced mainly in developing countries.

Paternal Support and Full Childhood Immunization

In the past, father's contribution to the child's growth and development were evaluated by the societies and academics in terms of his financial contributions only. Consequently, separations of parents were considered detrimental to the child, because of the concomitant financial loss of such separation to the mother (Teiler, 2000). Presently, societal expectation in many cultures is that fathers should provide for the family's financial care, emotional care and access to external social support. Father's co-operation in parenting depends on his view and attitude toward the needs of a child. A study on the view and feelings of fathers on the need of a child was conducted in Brisbane, Australia.

The study interviewed 678 parents including 267 fathers and indicated that fathers have varying belief and attitude about different needs of the child, including the need to communicate with the child (Halle et al., 2008).

Ball and Moselle (2007) opined that father's presence and contribution has connection with the development of a conducive social atmosphere for the family and child. The social environment/circumstance relates to and mediates development, behavior, health, and survival of the child. Supporting this ascertain, WHO (2007) stated that paternal engagement in parenting a child influences both physical health and social skill of the child throughout life, from the neonatal to the adult stage. One of the pathways through which paternal co-operation in co-parenting influences the child is the tendency to reduce the magnitude of parenting stress on the mother, which will offer her better chances to care for the child (Ball & Moselle, 2007).

Influence of family support and paternal education to complete childhood immunization had been studied (Adeyinka et al., 2009; Rammohan et al., 2012). Paternal support has been demonstrated to be an important factor in maternal and child health outcome and service utilization. Maternal practice of exclusive breastfeeding, parenting stress among mothers, psychological and emotional wellbeing of the mother, the infant and the maternal mortality are all significantly associated with paternal support (Dashti et al., 2010; Geller, Copper, Garfinkel, Schwartz-Soicher, & Mincy, 2012; Plantin, Olukoya, & Ny, 2011; Yoon, Hwang, & Cho, 2009).

Ploeg et al. (2013) studied the influence of parental faith and motivation on physical activities of the 5th grade children. The study was a cross-sectional study involving 1,355 5th grade students from 30 schools in Alberta, Canada and their parents. Data were collected in 2009 and 2011.

Chi-square and t tests tested the difference between 2009 and 2011 data, and between genders. Univariate and multivariate regression analysis tested the association between level of physical activities and variables such as parental encouragement and participation in physical activities. The study indicated that the parental encouragement is positively associated with increased physical activities among the 5th grade students. The study outcome is consistent with another study that linked the father's presence and engagement with youth behavior (Zhang & Fuller, 2012).

A study was conducted on the relationship between father's supportive concern and neighborhood disorder with 775 non-resident fathers and 1,407 resident fathers as selected participants (Zhang & Fuller, 2012). The level of participation of non-resident father in child co-operating is associated with resident disorder (Zhang & Fuller, 2012).

How marital satisfaction and parenting support relates with maternal parenting stress was evaluated among employed and unemployed mothers (Yoon et al., 2009). The study was a cross-sectional study design that interviewed 175 employed and unemployed women. From this study, it was revealed that marital satisfaction and real paternal support predict reduced parental stress among women. The study supported the

observation of the researchers that high level paternal involvement in co-parenting reduces maternal parenting stress (Ball & Moselle, 2007; Ghosh, Wilhelm, Dunker-Schetter, Lombarrdi, & Ritz, 2010).

In a retrospective case-control study Ghosh et al (2010) assessed the influence of paternal support during pregnancy and chances of preterm birth. The study had 1,027 mothers who had preterm birth as case while 1,282 mothers who had full term birth as control.

Women lacking high paternal support has higher odds of preterm birth (*OR*: = 2.15, 95% *CI:* = 0.92, 5.03; Ghosh et al., 2010). The researchers observed the paternal support mediates the effects of chronic psychological stress and pregnancy to preterm birth. This is similar to the observation that the paternal involvement during pregnancy and childbirth is associated to child and maternal morbidity and mortality (Plantin et al., 2011).

Dashti et al. (2010) examined factors that influence exclusive breastfeeding practice in Kuwait. The study was a longitudinal prospective study design with 373 women during their post-partum period. Paternal support for breastfeeding is associated with the practice of exclusive breastfeeding. Although the researchers observed that factors like social class, woman's age and culture influence the practice of exclusive breastfeeding. The relationship between paternal support and breastfeeding is similar to

the finding of another research (Tohotoa et al., 2009). Longitudinal studies can be used to assess time sequence of variable and results are generalizable.

Rammohan et al. (2012) determined the influence of the paternal level of education and childhood measles immunization status in six least performing nations. Data from six least performing nations in the global target for measles immunization was analyzed. The study revealed that paternal education up to secondary is an independent predictor of child measles immunization status. (Rammohan et al., 2012). These studies recorded above are consistent in demonstrating the influence of father's involvement to the well-being of the mother and child. As discovered in the practice of infant breastfeeding (Dashti et al., 2010; Tohotoa et al., 2009), full childhood immunization requires a mother's determination, sacrifice, understanding and paternal support may be essential.

Maternal Education and Retention of Immunization Documentation

Study relating maternal education with the maternal retention of immunization documentation is scarce, but maternal education is an important determinant of health status, health facility utilization, and health behavior. Studies in Nigeria, Ethiopia, Kenya, and India had shown significant positive association between maternal education and full childhood immunization and use of maternal and child health facilities by mothers (Abuya et al., 2011; Etana & Deressa, 2012; Odusanya et al., 2008; Singh, Rai, et al., 2012). Conversely, study in Canada and Somaliland are not consistent with these

findings. In Canada a negative association is observed between maternal education and complete childhood immunization while no association is observed in Somaliland study (Dummer et al., 2012; UNICEF, 2008). The study findings in Canada might be due to the negative impact on the anti-vaccination groups' information among educated parents. Almost all the mothers in Somaliland were illiterate so the impact of maternal education may not be detected, and the sample size is small (n=280) for the study.

Maternal knowledge of the Importance of Immunization Documentation and Retention of Immunization Documentation

Cognitive appreciation and understanding of the importance of health behavior predisposes compliance. Maternal knowledge of the importance of immunization documentation has not been studied. However, studies have demonstrated an association between health behaviors as full immunization with maternal knowledge of the importance of immunization (Braka et al., 2012; Etana & Deressa, 2012; Owais et al., 2011).

Maternal Age and Retention of Immunization Documentation

I could not find any study on the relationship between the maternal age and the maternal retention of immunization documentation. However, age had been shown to be one of the personal factors that can influence health behavior and outcome. Singh, Pallikadvath, et al. (2012) indicated that the mother's age is one of the factors associated with full maternal tetanus immunization. The finding of another study in India that

indicated association between utilization of maternal and child health services among adolescent mothers with maternal age supports the above position (Singh, Rai, et al., 2012).

Critique of Methods

Dummer et al. (2012) employed historical cohort study design to examine factors relating to full immunization. The sources of information were physicians billing system, public health record and census data. The researchers observed that the types of service rendered, and socio-economic status are associated with full childhood immunization. Retrospective administrative source of data may not be complete, and the validity of the record may be affected by the ability of the recorder to record completely and accurately. Potential study participants who did not use the services of the public facilities may be excluded.

Investigator used prospective cohort study to assess factors affecting the completion of DTP immunizations in Pakistan. Three hundred and seventy-three study participants were followed-up for 90 days from the day of (DTP_1) first DTP immunization (Usman et al., 2010). In this study, age of the child, family income and proximity to immunization facility impact full DTP immunization. The result of this study might be influenced by loss in follow-up. The participants may not represent the larger community since only those who used a certain facility were studied. The above reasons will affect the generalizability of the results.

In the U.S., data from National Immunization Survey were applied to examine the effect of parental belief on immunization, delay or refusal of immunization on full childhood immunization (Smith et al., 2011). The investigators observed that lack of belief in immunization is relates to delay or refusal of immunization and consequently is associated with full immunization (Smith et al., 2011). Participants of National Immunization Survey may not represent the characteristics of the general population. None representativeness of the group was because the survey was a telephone-based survey and only households where landline telephones exist can be included in the study. Statistical test employed here was the t-test of difference. Full childhood immunization status is a variable that has many covariables, but crude association only can be inferred with t-test statistic.

Antai (2009) and Singh (2013) used National Demographic and Health Survey (DHS) data to study factors associated with full childhood immunization status in Nigeria and India respectively. Both studies revealed that the full childhood immunization is associated with both ethnic and geographic difference in these countries. DHS may lack demographic information necessary for the study. Second, since DHS was a nationwide survey in developing countries, it may suffer from logistic and administrative difficulties that may negatively affect the survey outcome.

Cross-sectional survey is a popular study design for researchers in the study of full childhood immunization. Adeyinka et al. (2009) and Ba'amer (2010) conducted

descriptive survey on full childhood immunization and its determinants in Nigeria and Yemen respectively. Ba'amer (2010) employed WHO standard EPI survey procedures in the determination of sample size, sampling of participants and collection of data. Conversely, Adeyinka et al. (2009) neither stated that these standards were adopted nor provided information about the reliability and validity of the data collection instrument employed in the study. In both studies, proximity to immunization facility impacts full childhood immunization. Family/cultural support and long waiting period influence childhood immunization status (Adeyinka et al., 2009). Lack of immunization information negatively influences full childhood immunization in Yemen (Ba'amer, 2010). Cross-sectional survey cannot establish cause-effect relationship and cannot establish time trends between the variables, but it has the advantage of assessing relationships rapidly. The above household cross-sectional surveys were descriptive surveys and inference on the association between variables could not be drawn based on the descriptive study alone. The studies have resemblances with my study methodology apart from being descriptive studies.

My study filled the knowledge gap on the influence of maternal satisfaction with postnatal serves factor and paternal support on full childhood immunization status. It will also fill the gap on the determinants of the maternal retention of immunization documentation. Etana and Deressa (2012) and UNICEF (2008) supported my study methodology since my study was a quantitative cross-sectional survey. Both studies

applied the WHO's EPI cluster survey standard in sample size determination, sampling technique, and data collection instrument. WHO has a standard training manual in EPI cluster survey, which I found valuable. In these studies, full childhood immunization coverage was the dependent variable. UNICEF's study varies from my study only because the study was a descriptive survey while mine is analytic survey. My study as an analytic survey design was similar in methodology with the study conducted by Etana and Deressa (2012). Again, my study employed univariate and multivariate logistic regression analysis to analyze the survey data.

Household survey has the advantage of selecting the representatives of the community of interest and is not affected by the problem of inaccurate denominator, mostly when authentic population census is not available (Burton et al., 2009). The study design is only suspected to suffer from the effect of bias that might be presented by the use of maternal recall in collecting information on immunization status (Usman et al., 2010), but study had already validated maternal recall as means of eliciting immunization history (Burton, 2009). Moreover, a statistical tool like univariate and multivariate regression analysis may improve the methodological limitations if any in this cross-sectional survey (Frankfort-Nachmias & Nachmias, 2008).

Summary

The gain of universal childhood immunization is eluding Nigeria due to low full childhood immunization coverage and consequent high infant mortality. Full childhood

immunization coverage measures the extent to which target population is served with all the required doses of vaccines and is important in program evaluation. Jenner introduced the first documented vaccine (smallpox vaccine; Henderson, 1997), but many vaccines have been introduced in the present era. The availability of many potent vaccines against maternal and childhood diseases gave impetus to EPI program.

Full childhood immunization has been studied by researchers with community-based surveys; secondary data based survey, and cohort study designs. Prominent independent variables that impacted full childhood immunization status are maternal personal characteristics: age, education, income, occupation, marital status, knowledge of immunization schedule, and benefit of immunization. Child's characteristics: child's age, gender, place of delivery, birth order and interval; demographic characteristics: level of public infrastructure development, urban-rural setting, and migration were among the studied variables. Finally, studied variables include system features: examples are proximity of service facilities, vaccine cold chain system, long waiting at the facilities, and attitude of service providers. Areas where knowledge gaps still exist are effects of paternal support, maternal satisfaction with postnatal services, on full childhood immunization status; and association between maternal factors and the maternal retention of immunization documentation.

In the next chapter, the quantitative research designs that will test the association between the variables of the study, the instrument of data collection, and the statistical

analysis of data will be described in details. Chapter 4 will present an analysis of data while Chapter 5 will contain the discussion of findings.

Chapter 3: Research Method

Introduction

The study was a quantitative cross-sectional survey research design. It involved a survey data collection. I conducted a population-based childhood immunization survey to obtain data required to answer research questions in this study. The study setting was Owerri. Owerri, the state capital, is located in Imo state of Nigeria, in West Africa. Owerri comprises three local government councils. I used the WHO/EPI-30 cluster survey sampling technique for sampling. It is a two-stage sampling method that uses sample probability proportional to the population size to select samples. I selected 30 out of the 45 clusters in Owerri.

In this study, I assessed whether paternal support and maternal satisfaction with the postnatal services were associated with full childhood immunization status. Also, I examined if there is an association between the maternal retention of immunization documentation and maternal age, maternal education level, and maternal knowledge of the importance of immunization documentation (immunization card).

I adapted WHO/EPI-30 cluster immunization survey form to the need of this research and the setting of this study. Consequently, interviewer-administered survey forms were used in this study. The survey form aided the collection of sociodemographic and childhood related immunization information from mothers of children age 12-23 months.

At the age of 12 months, a child in Nigeria is expected to have received all the recommended 12 doses of vaccines. Administered vaccines are recorded in a personal immunization documentation (immunization card) kept under the custody of the mother. This document was the major part of the basis for immunization data gathering. Data were entered into a computer system with the aid of Epi-Info software and later exported to SPSS software for analysis

Research Design and Approach

The research was a quantitative survey research design. Survey is a means by which researchers measure and classify the given characteristics of a larger group by administering data collection instrument on a subpopulation and generalizing result to the entire group (Creswell, 2009). Survey has the advantages of data collection from a large sample, thereby increasing the required statistical power; it is less expensive, saves time and is reliable. The study was a cross-sectional survey, implying that data was collected at one point in time. The study involved primary data collection with interviewer-administered survey form. I adapted WHO/EPI-30 cluster survey form for the collection of childhood immunization status and other related information from the mothers of children aged 12-23 months.

The researcher examined factors that related to full childhood immunization status and the maternal retention of immunization document. Full childhood immunization status was measured by being ‘up to date’ in prescribed childhood immunization series

and evidenced by immunization documentation or maternal recall. The scheduled set is 1.3:3:3:1:1 series were used for full childhood immunization (up-to-date) status for children between the ages of 12 and 23 months. Maternal presentation of immunization documentation (immunization card) for the same child measured the maternal retention of immunization documentation.

Justification for Using this Design and Approach

Cross-sectional studies can be executed timely at reasonable cost and results can be inferred easily to the entire population (Aschengru, & Seage III, 2008). Survey is suitable for the study of a large district as Owerri with well dispersed sub-units. Also, immunization study has shown that a survey is the best technique of validating administrative records on immunization (He et al., 2012). Immunization survey can be an efficient method of gathering information where census data does not exist or is inadequate so as to avoid biased estimate due to inaccurate denomination (Burton et al., 2009).

Again, unlike administrative data, which records only segments of the people using mainly public orthodox facilities; immunization survey can gather data from the representatives of the community (Burton et al., 2009). Finally, no published childhood immunization survey had ever focused these three local government councils in Owerri.

Statement of the Problem

The EPI, meant to protect children against child killer diseases had undergone some revisions to improve its performance since its inception in Nigeria, 1979 (WHO, 2012). However, despite these improvements, the immunization coverage rate and immunization documentation retention rate have remained unacceptably low (Abdulraheem et al., 2011; Odusanya et al., 2008). Consequently, Nigeria has one of the worst mortality rates for children under the age of five years (157 per 1000 live birth) in the world (Odusanya et al., 2008; NPC, & ICFM, 2009). While previous information about the importance of immunization in controlling the spread of disease in Nigeria is valid, there needs more of understanding on whether paternal support and maternal satisfaction with postnatal services predict full childhood immunization status. Also, the association between maternal factors and the maternal retention of immunization documentation needs more understanding (immunization cards).

Factors interacting with poor childhood immunization status are not well known (Abdulraheem et al., 2011). Khowaja et al. (2012) observed that the trust in government health services, availability and accessibility of immunization services and social-demographic factors were related to childhood immunization status. Maternal education, remembering immunization due dates, knowledge of immunization benefits, community stakeholders support were associated to childhood immunization status (Ategbo et al., 2010; Odusanya et al., 2008). Literature on the impact of paternal support and maternal

satisfaction on the postnatal services factors on full (complete) childhood immunization is scarce. Study on impact of maternal factors on the maternal retention of immunization documentation was also scarce. The study was to fill these gaps.

Setting and Sample

Setting

Owerri is in Imo state, Southeastern geographical zone of Nigeria, West Africa. Owerri comprises three local government councils out of 27 local government councils of Imo state. Owerri is the Imo State capital. The three local government councils have 45 political wards (which will form clusters) and a population above 0.5 million people. About 17% of the population consist of 9-24 months old cohorts (Owerri Municipal Council 2007; Owerri North Council, 2007, Owerri West Council, 2006).

Sampling Size Determination

WHO (2005) stated that sample size for estimating immunization coverage in an area should be guided by:

The feasibility of collecting data from all selected children in a cluster in one day

The possibility of reaching selected clusters within the specified data collection period. This consideration is underscored by the fact that WHO's recommendation is that survey data collection should not last more than one month.

To ensure that the samples size for the study yielded adequate power, I calculated power analyses for the independent variables. I computed minimum sample size for each

independent variable of the study using 80% statistical power at 95% confidence interval with open Epi free software (http://openepi.com/v37/SampleSize/SSCohort.htm) power calculator for cross-sectional study design.

Quantitative studies relating paternal support and childhood immunization was very scarce. Consequently, I used the result of the study on marital status of mothers and complete childhood immunization to compute the power analysis for paternal support. In the study, 472 mothers were married while 64 mothers were not (Etana & Deressa, 2012). The prevalence of full childhood immunization was 31.2% for married and 3.5% for unmarried. The sample size was 195.

Studies were scarce on maternal satisfaction with postnatal services and full childhood immunization, but a study indicated that 449 and 281 postmenopausal women were satisfied and dissatisfied with osteoporosis treatment respectively (Huas et al., 2010). The compliance rate among the satisfied women was 42.6% and 20% for women not satisfied with the treatment. The calculated sample size was 146.

Studies on the association between the maternal retention of immunization documentation and maternal age were scarce. However, the outcome of the study on the influence of maternal age on childhood immunization status was used here. Etana and Deressa (2012) observed that 348 mothers were of ages 15-29 years old while 187 were 30 years and above old. The rates of full childhood immunization among them were

22.8% for ages between 15 and 29 years and 12.9% for ages 30 years and above. The computed sample size was 554.

Sanou et al. (2009) observed that the ratio of educated and uneducated mothers in an immunization coverage study was 39:88. Prevalence of complete childhood immunization was 43.3% and 13.3% for the educated and uneducated respectively. The minimum sample size was 72.

I used the literature on the maternal knowledge of the importance of immunization to plan for the power analysis of the variable, the maternal knowledge of the importance of immunization documentation. In an immunization coverage study, the ratio of mothers with the right knowledge of childhood immunization goal and mothers without the knowledge was stated as 426: 100 (Etana & Deressa, 2012). To measure this attribute the researchers asked mothers a *yes* / *no* question on whether vaccination is used to prevent disease. In this case, a *yes* response denoted a right answer, while a *no* indicated a wrong answer. The full childhood immunization coverage rates were 32.8% and 2.8% for mothers with the right knowledge and mothers that lack the correct knowledge respectively. The sample size calculation yielded 113.

The sample size required to test the hypotheses in this study ranged between 72 and 554. It suggested that a minimum case number of 560 were needed, but 2,240 survey forms were printed to plan for a possible poor return rate. The decision to print such extra number of forms was based on assumption not on scientific rationale and was very

useful during data collection. I considered the fact that some of the participants may misplace the form and may not be able to find it when required, that some participants may not even be found by the researcher for the collection of completed forms. I factored the wide gap in technological development between Lagos where I live and Owerri, the study area, since it might not be easy for me to reprint the survey forms in Owerri, if I ran short of them. Unexpected printing errors that could occur in some of the paper-based forms were also considered.

Sampling Method

Sampling is the art of choosing subgroup of the population for the study of reference characteristics of the community so as to make inference of the findings to the target community. Its advantages are economy of resources, timely achievement of data collection exercise, accuracy of findings and ability to accommodate sampling errors (WHO, 2005). The two main dominant classes of sampling methods are probability and non-probability sampling methods. The probability sampling methods are more scientific and more preferred because every element of the population has known chances of being selected. The sampling technique makes for selecting samples that represent the population and makes finding generalizable.

I used a cluster sampling here. The sampling procedure was a two-stage probability sampling method. Cluster sampling method was preferred here among other three probability sampling methods for the fact that the sampling frame of the whole

sample units would not required. In Owerri district, because the population is very large and highly dispersed geographically and there was no existing listing of all the households, drawing a sampling frame was very difficult and expensive. So since cluster sampling technique does not require listing of households, it was the most favored method for this study

The administrative ease and low cost associated with cluster sampling will allow for the selection of a large cluster that means large sample size and facilitate high precision of the estimate. Final, it makes the survey covering wide geographic area practicable and is the most economic sampling procedure. The study used a WHO/EPI30- cluster sampling technique in sampling. WHO/EPI 30-cluster sampling procedure was preferred because it is WHO's standard recommended sampling method for immunization coverage survey. EPI 30-cluster sampling is a two-stage sampling technique in which clusters (wards) are the primary sampling units, meaning first sampling is based on clusters. Households are then selected from the sampled clusters in the second step of the sampling. Selection of the clusters adopted a self-weighting sample probability proportional to population size to ensure that the sample units represent the same number.

Sampling Procedure

The cluster sampling here relied heavily on systematic sampling method. Systematic sampling is a sampling method where a predetermined interval is used to

select samples after simple random sampling method had been used to select the first element of the sample. That is choosing every subsequent K^{th} element after the first sampled element until the needed samples are collected. Systematic sampling is easy to implement; selection of samples can be equitably spread over the population thereby ensuring better representativeness of the sample than when only simple random sampling is used (WHO, 2005).

I calculated sampling interval by dividing the total district population with the number of clusters (30) to be sampled. The sampling interval was 17299. With the aid of the table of random numbers, I randomly selected a number that was equal or less than the interval (WHO, 2005). The process yielded 15904 and the first cluster with the corresponding population (either cluster with a population equal to or more than this 15904 from the table of random numbers) in the cluster sample frame was selected for the study. Then I added the interval value to the population of the first cluster; the next cluster with corresponding population became the second selected cluster. I continued with this exercise until the 30 required clusters were sampled.

In choosing households, each selected cluster was subdivided into quadrants. In each quadrant, a central point was located from which bottle spinning (a random sampling method) was used to select the direction of the sampled households. Adopting this method improved the validity of household samples (Sheth, Trivedi, Melita, & Oza, 2012). A complete listing of all the households in the selected direction was made.

Starting from the first household in that direction, five eligible households were selected and this procedure was repeated in all the quadrants in the selected clusters as researchers suggested (Dhillon, Subramanian, Mulokozi, Rambeloson, & Rolf, 2013).

It implies that 600 eligible mothers of children aged 12-23months were selected, but only 560 survey forms were analyzed. Once the first household was selected; in tandem with Ethiopian immunization survey, selection was based on the nearest household that met the inclusion criteria (Etana & Deressa, 2012). Where there were two children that met the inclusion criteria in a selected household, the mother of the youngest child was selected or interviewed. Where eligible mother had multiple babies of the same age, one of the babies was selected through simple random sampling.

Eligibility Criteria for Participants

Inclusion Criteria were: Mothers must be 18 years and above old. Mothers of children aged 12-23 months and who had lived in the area for at least 12 months were eligible to participate in childhood immunization survey. The choice of age ranged 12-23 months is suitable for countries where primary series of childhood immunization doses were planned be completed for a child at the age of 9 months. The criteria gave an opportunity to include all children who were expected to have currently concluded all vaccination doses (WHO, 2005). In most childhood immunization surveys these criteria were applied (UNICEF, 2008; Etana & Deressa, 2012; Oyo-Ita et al., 2012). Participants communicated either in English language (official language) or Igbo language (native

language). Where in a selected household two mothers met other inclusive criteria, the mother of the youngest child was selected.

Exclusion Criteria for Participants

Exclusion criteria were:

Mothers below the age of 18 years old, mothers of children whose ages were less than 12 or greater than 23 months;

Mothers of children whose ages were between 12 and 23 months, but had not lived up to 12 months in Owerri the study area;

Mothers of children between the ages of 12 and 23 months, but could neither communicate in English Language nor Igbo language;

Mother of the older child when two mothers met other inclusive criteria in a household was l not selected.

Instrument and Material

Name and type of Survey Instrument

There were no secondary data that could answer the research questions in this paper; therefore, I used an interviewer-administered questionnaire for data collection. Search on the availability of existing suitable standard instrument yielded none, but the WHO/EPI 30-cluster survey form (WHO, 2005). However, the survey form can only collect data for answering some of the research questions. WHO designed this instrument for the computation of immunization coverage rates in developing countries. The

measurements of many of the variables of the study were not considered in the instrument; therefore, there was a need for its modification to suit the purpose of this study (see Appendix A). Other researchers had modified this instrument to suit the peculiarity of their research before they applied it (Oyo-Ita et al., 2012; UNICEF, 2008; Etana & Deressa, 2012).

Information Collected

With the **s**urvey form, the researcher obtained information on demographic characteristics, childhood immunization status in relation to the 1,3,3,3,1,1 immunization series doses, and socioeconomic characteristics. Other information obtained through the survey form were maternal perceptions of her satisfaction level with the postnatal services, paternal support to childhood immunization and maternal knowledge of the importance of immunization documentation (immunization card). Most of the questions in the survey form were close-ended questions.

Data Collection and Analysis

Independent Variables

Independent variables for this study were paternal support, maternal satisfaction with the postnatal services, maternal age, maternal education level, and maternal knowledge of the importance of immunization documentation (immunization card). Data on these variables were collected thus:

Paternal support; I measured with question numbers 31 to 33. Three questions asked how often the father of the baby discusses positively or negatively about immunization and finances baby's immunization. A five-point Likert response scale was the basis for scoring individual questions from 1-5 (never to very often) but reversed when a negative question as question 32 was asked. Ghosh et al. (2010) adopted a similar measurement to assess the relationship between paternal support and preterm birth.

Maternal satisfaction with the postnatal services; I measured with questions number 27 to 28. These two questions were drawn from Otani (2012) measures of treatment satisfaction. The questions are on general satisfaction with postnatal services and willingness to recommend the health center to family and friends. A five-point Likert scale was used to score the response to a question beginning from 1 for very much unwilling/unhappy to 5 for very much willing/happy.

Maternal age; I measured with question number 4 in the survey form. It was measured by maternal oral testimony of her chronological age in years.

Maternal education level; I measured with question number 5 in the survey form. It was measured by the highest level of formal education (school) attained by the mother.

Maternal knowledge of the importance of immunization documentation; I measured with question number 29 in the survey form. It tested mother's understanding of the importance of immunization documentation (immunization card).

Dependent Variables

The dependent variables were the maternal retention of immunization documentation (immunization card) and full childhood immunization status. Data on these variables will be collected as follows:

Maternal retention of immunization documentation (immunization card); I measured with question number 13 in the survey form. It was measured by mothers presenting the document to the survey team for recording or not.

Full childhood immunization status; I measured through questions numbers 14 to 26. It was extracted from the child's immunization documentation (immunization card) or mother's recall where immunization documentation was not available.

Confounding Variables

Confounding variables in this study depended on the dependent variable of interest. For dependent variable, the maternal retention of immunization documentation, the confounding variables are marital status, family size, and family income. They were measured thus:

Marital status; I measured with question number 6 in the survey form. It was measured by maternal oral testimony of her marital status.

Family income; I measured with question number 9 in the survey form. Mother gave information on a range of family income per month.

Family size; I measured with question number 8 in the survey form. Mother gave information on the number of persons living in the household.

Confounding variables for full childhood immunization status were distance to immunization facility, maternal education level, place of delivery, maternal use of antenatal services, family income, place of abode, and maternal knowledge of the importance of childhood immunization.

Distance to immunization facility; I measured with question number 11 in the survey form. Mother gave information on the approximate distance (km) from home to the nearest immunization facility.

Place of delivery of the child; I measured with question number 10 in the survey form. Mother gave information on whether the delivery took place at a hospital/clinic or home.

Use of antenatal services; I measured with question number 7 in the survey form. Mother gave information on how many antenatal visits she made during the last pregnancy.

Place of abode; I measured via question number 3 of the survey form. It sought to indicate whether the area was urban or rural.

Maternal knowledge of the importance of childhood immunization; I tested through question number 30 of the survey form. Mother selected the correct answer if she knows the importance of childhood immunization.

Maternal education level and family income were independent and confounding variables respectively for the maternal retention of immunization documentation, and their measures had been defined earlier in this section.

Processes for Assessing Reliability and Validity of the Instrument

Validity of the instrument is concerned with the extent the instrument measures what it set out to measure. The reliability of the instrument is concerned with consistency of results measured by the instrument (Salkind, 2008). WHO developed the WHO/EPI 30-cluster immunization survey form which has been in use for population-based immunization survey for decades, but was modified for the study to accommodate data collection on some study variables not included in the original instrument (WHO, 2005).

Reliability of the survey instrument is enhanced by calculating confidence interval and enforcement of a standard protocol in data collection and analysis. A confidence interval is a parameter estimate from statistic indicating the range a population parameter can be located using a point statistic measurement (Gerstman, 2008). The common confidence interval (CI) in the use is 95%. Estimating parameters in this range increases the reliability of measures than the point estimate. The WHO/EPI 30-cluster survey form allows the immunization rate to be measured and presented in confidence interval.

Establishment of study protocol that will ensure high quality of data is important. WHO developed a standard protocol that is used in the immunization survey to ensure

that the information is properly measured, collected, and results appropriately documented.

Threat to validity

Care was taken to guide against the following potential threats to validity of data collected in the survey.

One selected household having more than one eligible child between the ages of 12 and 23 months,

Mother and child having not lived in the area for 12 months,

Maternal inability to present immunization document to the survey interviewer,

The existence of obvious language barrier between mother and the interviewer,

The use of inaccurate population estimate to compute the weighted cluster sample.

How Scores are Calculated

Likert scale questions have responses that are coded 1 to 5. Operationally, I decided to collapse the rating categories to binary codes. In doing this, I considered that in the current healthcare system only high scores of clients' perspectives concerning health care services might be good enough to predict clients' behavior (Otani et al., 2009). Otani et al. (2009) observed that in measuring patients' satisfaction for instance, focus should be on the highest rated answer on a five-point Likert scale, because the continuous loyalty of merely satisfied client cannot be relied on.

Three Likert questions collected data for measuring paternal support while two Likert questions collected data to measure maternal satisfaction with postnatal services variable. For each participant, I recoded mean scores of four and above to "1" and less than four to "0". Based on these recoding "1" may be referred to as 'good paternal support' or 'having satisfaction with postnatal services'. In the same vein, "0" may denote 'no paternal support' or 'lack of satisfaction with the postnatal services' as the case may be. One question measured maternal knowledge of the importance of childhood immunization services and has one correct answer "prevention of childhood vaccine-preventable diseases". Other responses such as preventing all childhood diseases, preventing childhood malnutrition, preventing childhood malaria, preventing childhood parasitic worm infections are just detractors and are not correct. Similarly, the question that measured maternal knowledge of the importance of immunization documentation has one correct answer "identifying which immunization is given and due". Other alternative responses such as identifying the age a child is due for immunization, identifying where the child is born, identifying where immunization center is situated and identifying agency that sponsored the immunization are not correct. Consistent with approaches adopted by Odusanya et al. (2009), I coded the responses to "1" for the correct answer and "0' for an incorrect answer.

Administration of Survey Instrument

The instrument of data collection was researcher-administered survey instrument. The researcher secured the consent of each participant before the administration of the questionnaire.

Location of Data

Completed forms were kept under my custody. I kept these forms confidential and secure during and after the completion of data entry and analysis. Data were stored in my password-protected laptop, preventing any unauthorized access to the data.

Data Analysis

To control errors, in the field completed forms were screened manually for coding errors, completeness and eligibility of writing. Any error detected was corrected immediately. The data entry was performed in Epi-info software. List command was used to review entries by variables to identify any irregular entry. The researcher plotted frequency tables to check errors. All the dependent variables are classified as categorical binary variables. Data were entered into a computer system with the aid of Epi-Info computer software and transported to SPSS version 19 software for statistical analysis. Epi-Info is a good software for community health diagnosis, mainly because of its versatility. CDC developed Epi-info software.

SPSS software is a statistical package that can perform many data analytical functions. Frequency table and other descriptive statistical tools were employed to

present the data. Univariate Chi-square statistic Test tested the crude association between the dependent variables and covariables variables. Acceptable significant level (α) was $p \leq 0.05$. Independent variables that were significant at $p \leq 0.05$ and passed other necessary tests entered multivariate logistic regression analysis model.

Adjusted odds ratio at 95% confidence intervals was computed. Logistic regression analysis was the statistical test of choice here, because the dependent variables were dichotomized to full childhood immunization or not full childhood immunization, retention of immunization documentation or non-retention of immunization documentation. In this study, dependent variables are childhood immunization status and the maternal retention of immunization documentation (immunization card). Paternal support, maternal satisfaction with postnatal services, maternal education level, maternal age and maternal knowledge of the importance of immunization document were independent variables.

Statistical Analysis

1: Is there an association between maternal satisfaction with the postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization)?

Ho_1: There is no association between maternal satisfaction with the postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization)

H_{a1}: There is an association between maternal satisfaction with the postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization).

Chi-square test of association from two-way table tested crude association between maternal satisfaction with the postnatal services (independent variable) and full childhood immunization status (dependent variable). Multivariate logistic regression analysis tested adjusted association between those two variables adjusting for distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization. I fixed acceptable significant level (α) at $p \leq 0.05$. I computed odds ratio at 95% confidence interval.

2: Is there an association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables

(distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization)?

Ho_2: There is no association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization).

Ha_2: There is an association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of childhood immunization).

Chi-square test of association from two-way table tested crude association between paternal support (independent variable) and full childhood immunization status (dependent variable). Multivariate logistic regression analysis was used to test adjusted association between these two variables adjusting for distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural] and maternal knowledge of the importance of

childhood immunization. I fixed acceptable significant level (α) at $p \leq .05$. I computed odds ratio at 95% confidence interval.

3: Is there an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)?

Ho_3: There is no association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)

Ha_3: There is an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)

Chi-square test of association from two-way table tested crude association between maternal education (independent variable) and the maternal retention of immunization documentation (dependent variable). Multivariate logistic regression analysis computed adjusted association between these two variables adjusting for marital status, family size and family income. I fixed acceptable significant level (α) at $p \leq .05$. I computed odds ratio at 95% confidence interval.

4: Is there an association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)?

Ho_4: There is no association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income).

Ha_4: There is an association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income).

Chi-square test of association from two-way table tested crude association between maternal age (independent variable) and the maternal retention of immunization documentation (dependent variable). Multivariate logistic regression analysis computed adjusted association between these two variables adjusting for marital status, family size and family income. I fixed acceptable significant level (α) at $p \leq .05$. I computed odds ratio at 95% confidence interval.

5. Is there an association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)?

Ho_5: There is no association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size and family income)

Ha_5: There is an association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of the immunization documentation covariables (marital status, family size and family income).

Chi-square test of association from two-way table tested crude association between the maternal knowledge of the importance of immunization documentation (independent variable) and the maternal retention of immunization documentation (dependent variable). Multivariate logistic regression analysis tested for adjusted association between these two variables adjusting for marital status, family size and family income. I fixed acceptable significant level (α) at $p \leq .05$. I computed odds ratio will be at 95% confidence interval.

Ethical Issues and Protection of Participants' Rights

The study was subjected to the approval of Walden University's Institutional Review Board. The Walden University approval number for the study is 10-06-14-0249345. The study participants read and understood an informed consent form (see Appendix C) before giving consent to study. The informed consent form assured the participants that their participation was voluntary and could be withdrawn at any point during the survey. The participants were informed that participation would bring neither harm nor reward to them. It also explained the purpose of the data collection and the

confidentiality of data collected. For the purpose of confidentiality, personal identifiers such as names and addresses were not collected in this survey.

Pilot Testing

Two public health **e**xperts from the academia and field practice reviewed and validated the survey instrument. Expert review of the question items and responses were based on the following attributes:

Questions' tendency to achieve the research purpose and provide answers to the research questions.

Whether the questions and responses are clear, unbiased, concise, has appropriate language level and not too difficult for the respondents.

Whether the responses are relevant to questions and provide all inclusive responses.

They reconciled any difference in their opinions before the survey forms were produced for pilot testing. Survey forms were pretested with 30 participants with similar characteristics with the study participants, but drawn from areas outside the selected clusters. However, only 29 matched survey forms were used for reliability rating. The situation arose because one of the earlier participants was not available to complete survey the second time. For the determination of test-retest reliability rating, the survey forms were administered to the same participants twice within an interval of ten days. Numeric scores were assigned to each participant's responses in both test and post test

completed questionnaires. Test-retest reliability was assessed with Pearson's coefficient of correlation (*r*). Under this test statistic, *r* value is good if it is at least 0.70. Internal consistency reliability assessment of some question items with Likert scale responses were done by computing Cronbach's alpha reliability coefficient.

Summary

In this chapter I have described the research method, a quantitative cross-sectional survey that assessed the predictors of full childhood immunization status and the maternal retention of immunization documentation (immunization card). Participants in the survey were mothers of children aged 12-23 months old. Cluster sampling technique was used to select study participants. I used the survey forms to collect information from mothers. The survey form was validated, pretested and subjected to the required revision before use. Data collection process was subject to the approval of the IRB of Walden University.

Data collected with these interviewer-administered survey forms were used to test the hypotheses of the study. The dependent variables of interest in the study were childhood immunization status and the maternal retention of immunization documentation (immunization card). Similarly, the independent variables are paternal support, maternal satisfaction with the postnatal services, maternal education level, maternal age, and maternal knowledge of the importance of childhood immunization.

Chi-square test of association from two-way table was used to test the association between each dependent variable and each relevant independent variable. Multivariate logistic regression was employed to determine the individual contribution of independent variables in predicting the dependent variable.

The next chapter, Chapter four, analyzes the data collected with the survey forms childhood immunization status and its related variables. Chapter five discusses the results of the study.

Chapter 4: Results

Introduction

In this chapter I presented the findings of the study and data analyzes in a way to test hypotheses and answer research questions. First is the recapitulation of the study purpose, research questions, and hypotheses. I presented a summary of data collection and sampling procedures. Then the descriptive and analytic statistics of the survey data is described.

Purpose of the Study

The purpose of the study was to assess the association between maternal satisfaction with postnatal services, paternal support, and full childhood immunization status. Also, among the purpose was to determine the association between the maternal retention of immunization documentation and maternal personal factors in Owerri, Nigeria. I adapted World Health Organization's 30-cluster survey form for this study. The respondents shared information on the sociodemographic, their child's immunization history, and their opinions concerning their level of satisfaction with postnatal services and level of paternal support they received. Full Childhood immunization status was measured by vaccination history recorded in immunization documentation plus recall. Maternal retention of immunization documentation was measured by the mother presenting the immunization documentation (immunization card).

Research questions were:

Are maternal satisfaction with postnatal services and paternal support associated with full childhood immunization status?

Are there associations between maternal factors (maternal age, maternal education level and maternal knowledge of the importance of immunization documentation) and the maternal retention of immunization documentation.

The null hypotheses were:

Maternal satisfaction with postnatal services and paternal support are not associated with full childhood immunization status.

There are no associations between maternal factors and the maternal retention of immunization documentation.

Pilot Study

I pretested survey forms with 30 participants with similar characteristics with the study participants but drawn from areas outside the selected clusters. However, only 29 matched survey forms were used for test-retest reliability rating. The reason for having only 29 matched survey forms is that one of the participants that completed the form at the initial round of the survey could not be reached when the second round was conducted.

For the determination of test-retest reliability rating, I administered the survey forms to the same participants twice within an interval of ten days. The total scores for each participant in the test and retest session were paired for the computation of the

Pearson correlation coefficient r. Test scores have mean (*m*) = 65.10%, standard deviation (SD) = +/_ 10.34. The retest scores have mean *m* = 63.34%, and a standard deviation (SD) = +/_8.61. The test-retest reliability value was .849.

There were two questions (28 and 29) related to maternal satisfaction with postnatal services. Question 28 had a mean of *m* =3.570, and standard deviation of *SD* = +/_1.501. Question 29 had mean of *m* = 3.87, and standard deviation of *SD* = +/_1.432. The internal consistency for this group of questions is (Cronbach's α) .830. Similarly, three questions (32, 33, and 34) related to paternal support. In the pilot study, question 32 has mean (*m*) =3.53 and standard deviation (*SD*) = +/_1.634. Question 33 has mean (*m*) = 3.63 and standard deviation (*SD*) = +/_ = 1.691. Question 34 has mean (*m*) = 3.97 and standard deviation (*SD*) = +/_1.564. The Cronbach's α internal consistency is .927. No observation from the pilot test warranted any significant revision of the survey instrument, data collection protocol or data analysis technique. So the data collection proceeded as planned.

Descriptive Statistics

I adopted World Health Organization's 30-cluster sampling technique to select 560 mothers of children whose ages were between 12 and 23 months. The study was a population-based survey in which the awareness of the study was first created in the selected communities before the distribution of survey forms to eligible participants who accepted to participate. The total number of survey respondents used in the analysis was

560. The respondents' characteristics are presented in Table 1. About 68.4% (*n* = 383) lived in rural area while 31.6% (*n* = 177) lived in urban area. The majority of the respondents, 63.6% (*n* = 356) were 30 years old and above, and the majority of the respondents 91.1% (*n* = 510) were married while 0.9% (*n* = 5) were divorced.

The majority of the survey participants, 64.8% (*n* =363) had secondary education and above. Seventy-eight percent (*n* = 439) of the respondents shared that they visited antenatal clinics more than thrice during their last pregnancy. The family size among the respondents was 3-4 for the majority (34.8%; *n* =195) and less than 3 for the minority (9.6%; *n* = 54). Only 0.2 % (*n* = 1) selected the highest family income level (more N400, 000 per month [N165 is equivalent to US$1] while the majority 64.3 % (*n* =360) had family income between N20,000 and N150,000 per month. The survey respondents who delivered their babies at an orthodox health facility were 544 (97.1%) while 0.49 % (*n* =2) delivered at Traditional birth attendants' facility. Orthodox facility is a hospital or clinic or health center or maternity home. The distance from household to childhood immunization center was 1-2km for the majority of the survey respondents, 19.5% (*n* =109) lived less than 1km from the childhood immunization center. About 62% (*n* =349) of the mothers presented childhood immunization documentation (immunization cards) for their babies. The survey indicated that 47.3% (*n* =265) and 63% (*n* =353) of full childhood immunization was measured by immunization documentation only and immunization documentation plus maternal recall respectively.

Table 2 shows the descriptive statistics of maternal postnatal service satisfaction, paternal support, maternal knowledge of the importance of childhood immunization and importance of immunization documentation. About 50% (*n* =281) of the mothers shared that they were satisfied with postnatal services and 60.5% (*n* =339) selected that they had paternal support while presenting their children for immunization sessions. Only 37.3% (*n* =209) of the respondents selected that the importance of childhood immunization was to prevent childhood immunization preventable diseases. Maternal knowledge of the importance of immunization documentation was demonstrated by 62.7% (*n* =351) of the respondents.

Table 1

Descriptive Characteristics of Mothers and Children's Immunization Status Owerri Nigeria, November, 2014

Variable	Frequency (*N*=560*)	Percent
Place of residency (*n* = 560)		
Urban	177	31.6
Rural	383	68.4
Mother's age (*n*=560)		
< 20 yrs	7	1.3
20 – 30 yrs	197	35.2
30 yrs	356	63.6
Marital status (*n*=560)		
Single	29	5.2
Widow	6	2.9
Divorce	5	0.9
Married	510	91.1
Maternal education level (n=560)		
None	21	3.8
Primary	176	31.4
Secondary	101	18.0
Professional	80	14.3
University	182	32.5

(table continues)

Variable	Frequency (*N*=560*)	Percent
Number of antenatal visits (*n*=560)		
None	5	0.9
Once	4	0.7
Twice	25	4.5
Thrice	87	15.5
>Thrice	439	78.4
Family size (*n*=560)		
< 3	54	9.6
3 -4	195	34.8
5 –6	183	32.7
>6	128	22.9
Family income (XN1,000 per month; *n*=560)		
<20	141	25.2
20 – 150	360	64.3
151 – 400	58	10.4
>400	1	0.2

(table continues)

Variable	Frequency (*N*=560*)	Percent
Facility of delivery (*n*=559)		
Orthodox facility	544	97.1
Home	13	2.3
Traditional birth attendant (TAB)	2	0.4
Distance to immunization center (*n*=558)		
<1Km	109	19.5
1-2Km	327	58.4
>2Km	122	21.8
Immunization card (*n*=560)		
Yes	349	62.3
No	211	37.7
Full childhood immunization Status by card only (*n*=560)		
Yes	265	47.3
No	295	52.7
Full childhood immunization Status by card and recall (*n*=560)		
Yes	353	63.0
No	207	37.0

Note. * = The sum may vary from *N* because some of the values were missing.

Table 2

Descriptive Characteristics of Maternal Perceptions on Childhood Immunization Services Owerri Nigeria, November, 2014

Variable	Frequency (N = 560*)	Percent
Maternal postnatal satisfaction (n = 560)		
Yes	281	50.2
No	279	49.2
Paternal support (n = 560)		
Yes	339	60.5
No	221	39.5
Maternal knowledge of the importance of childhood immunization (n = 559)		
Yes	209	37.3
No	350	62.5
Maternal knowledge of the importance of immunization documentation (n = 560)		
Yes	351	62.7
No	209	37.3

Note. * = The sum may vary from N because some of the values were missing.

Factors Affecting Full Childhood Immunization Status

The Chi-square test of association from a two-way table assessed the association between full childhood immunization status and some selected characteristics (variables). Table 3 shows the Chi-square test of association report. Significance level is fixed at p <.05 and statistically significant rows are highlighted. Ninety-six percent or more (96.0% or 271 of 281) of the respondents who were satisfied with postnatal services had fully immunized children while 70.6% (197 of 249) of those not satisfied with postnatal services had their children not fully immunized. Maternal satisfaction with postnatal service was significant ($p < .001$).

Full childhood immunization status was recorded for 70.5% (239/339) of mothers who reported having paternal support to childhood immunization. Paternal support had statistical significant ($p < .001$) association with full childhood immunization status. Sixty-seven (60.4% or 67/111) respondents who lived at less than 1Km to the immunization center indicated full childhood immunization. Two hundred and twenty (67.3%) respondents who lived at a distance of 1-2Km to the immunization centers indicated full childhood immunization. Full childhood immunization status was indicated for 54.1% (66 of 122) of the respondents who lived at a distance more than 2km to immunization centers. Distance to immunization center was significant ($p = .029$).

The percentage of mothers who reported full childhood immunization status for their children increased with increase in their level of education. The recorded

information was 80.2% (146 of 176) for university graduates, 77.5% (62 of 80) for professionals, 65.3% (66 of 101) for secondary school graduates and 40.1% (79 of 197) for those whose education levels were primary or less. Maternal education level was significant ($p < .001$). For the facility of child's delivery, 13.3% (2 of 15) of children delivered at home or traditional birth attendant facilities were fully immunized. Among those delivered in orthodox facilities, 64.3% (350 of 544) were fully immunized. Facility of child's delivery was significant ($p < .001$). The more the number of antenatal clinics attended during pregnancy, the higher the tendency to report full immunization for children. In this survey, full childhood immunization was recorded as follows: 41.2% (14 of 34) for less than three visits, 55.2% (48 of 87) for three visits while 66.3% (291 of 439) was for more than three antenatal visits. Antenatal visits were found statistically significant ($p = .004$).

Sixty-three (44.7%) respondents from families whose monthly income was less than N20, 000 (N165 is equivalent to US$1) had fully immunized children. Percent fully immunized were 68.3% (246 of 360) for families with monthly income N20, 000-N150, 000 and 74.6% (44 of 59) for those with above N150, 000 as monthly income. Again family income was significant ($p = .004$). Among the rural residents, 64.5% (247 of 383) had full immunization status for their children, while urban residents had 59.9% (106 of 177). Place of residence was not significant ($p = .170$). One hundred and thirty-four (64.51% either 134 of 209) respondents who demonstrated real knowledge of the

importance of full childhood immunization had fully immunized children. In the category without the real knowledge, 219 (62.4%) indicated full childhood immunization status. There was no significant association (p = .683) between maternal knowledge of the importance of childhood immunization and full childhood immunization status.

Mothers who were 30 years old and above had 66% (235 of 356) fully immunized children while mothers below 30years old had 57.8% (118 of 204) of fully immunized children. The association between maternal age and full childhood immunization was significant (p =.033). Over 77% (273 of 351) of mothers who demonstrated the real knowledge of the importance of immunization documentation had fully immunized children. Only 38.3% (19 of 50) of respondents without real knowledge of the importance of immunization documentation had fully immunized children. Maternal knowledge of the importance of immunization documentation was significant (p < .001).

Family size of the respondents was segmented into four groups. Two of the groups: 5-6 and more than 6 had a higher percentage of fully immunized children than others, 69.4% (127 of 183) and 65.6% (84 of 128) respectively. Family size had significant (p =.001) association with full childhood immunization status. Married respondents had a higher percentage (65.5% or 334 of 510) of children with full immunization status than respondents who were not married. Marital status was significant (p <.001).

Tables 9 and 10 show multiple logistic regression models with some variables and full childhood immunization status. Table 4 shows a multiple logistic regression analysis results between 11 covariables that had a significant association in the Chi-square statistic test of association from two-way table and full childhood immunization status. The overall percentage of correct classification of intercept only model is 63% while step 1 model indicates 83.5% correct classification. The Hosmer-Lemeshow test was not significant (χ^2=3.531; *df* =8; *p* =.897), meaning the model fits the data. The reported Nagelkerke R^2 is .609.

Participants who were not satisfied with the postnatal services had lower odds (*AOR* =0.013; 95% *CI* = 0.006, 0.030; *p* < .001) of full childhood immunization than those that indicated satisfaction with the postnatal services (reference group). Women from households with fewer members had lower odds (*AOR*=0.256; 95% *CI* =0.087, 0.748; *p* =.013) of full childhood immunization status than those from households with large members. Maternal satisfaction with postnatal services and family size were significantly associated with full childhood immunization status. Paternal support (*p* =.389), distance to immunization center (*p* =.333), maternal education (*p* =.488), facility of child's delivery (*p* =.360) and number of antenatal clinic visits (*p* =.353) were not significant in the table. Other covariables that were not significant in this multiple logistic regression model were family income (*p* =.372), maternal age (*p* =.569), maternal knowledge of the importance of childhood immunization (*p* =.589), and marital status (*p* =.363).

Table 5 shows the multiple logistic regression analysis results of all the independent variables and covariables with full childhood immunization status. The model has 13 independent variables and covariables irrespective of whether they were significant in the Chi-square test statistics of association from two-way table or not. The overall percentage of correct classification of intercept only model is 63% while step 1 model indicates 83.4% correct classification. The Hosmer-Lemeshow test was not significant (χ^2 =5.181; *df* =8; *p* =.738), meaning the model fits the data. The reported Nagelkerke R^2 is .612. Respondents without satisfaction with postnatal services had lower odds (*AOR*=0.013; 95% *CI*: 0.006, 0.029; $p < .001$) of full childhood immunization status than those satisfied with postnatal services (reference group). Again there is statistically significant association between maternal satisfaction with postnatal services and full childhood immunization status, adjusting for full childhood immunization status covariables. The adjusted co-variables were paternal support, distance to immunization center, maternal education level, facility of child's delivery, number of antenatal visits, and family income. Others were place of residence, maternal knowledge of the importance of childhood immunization, maternal age, maternal knowledge of the importance of immunization documentation, family size, and marital status.

Respondents with family size less than three persons had lower odds of full childhood immunization status (*AOR* =0.244; 95% *CI* =0.082, 0.726; *p* =.011) compared with those from families having more than six persons (reference group). Covariates that

could not show significant associations were paternal support (p =.370), distance to immunization center (p =.284 and p =.381 for categories less than1Km and1- 2Km respectively), maternal education (p =.422 for primary or no education at all, p =.676 for secondary school category, p =.676 for professionals). Non-significant variables included facility of child's delivery (p =.292), number of antenatal visits (p =.974 for less than three visits category and p =.358 for three visits category). Place of residence (p =.863), maternal knowledge of the importance of childhood immunization (p =.161), maternal age (p =.521), and maternal knowledge of the importance of immunization documentation were not significant. Also, marital status was not significant (p =.317). Maternal satisfaction with postnatal services and family size remained significant when controlling for all the selected covariables (see Table 5) and when controlling for those significant in the Chi-square test only (see Table 4).

Result Relative to Research Question 1

1: Is there an association between maternal satisfaction with postnatal services and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)?

Ho_1: There is no association between maternal satisfaction with postnatal services and full childhood immunization status controlling for full childhood immunization status

covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)

Sixty-three percent of the participants shared that their children had full childhood immunization status. About 50% of the respondents indicated that they were satisfied with postnatal services (see Table 2). Chi-square test of association from two-way table shows that 96.4% of the respondents who selected being satisfied with postnatal services indicated full childhood immunization status. Those unsatisfied with postnatal services and indicated full childhood immunization status were 52(29.4%). There was statistical significant association ($p < .001$) between maternal satisfaction with postnatal services and full childhood immunization status.

Table 4 shows the result of multiple logistic regression analysis adjusting for all independent variables and covariables that were significant with full childhood immunization status in the Chi-square test of association from two-way table. Respondents not satisfied with postnatal services had lower odds (*AOR* =0.013; 95% *CI* = 0.006, 0.030; $p < .001$) of full childhood immunization status compared with the respondents satisfied with postnatal services (reference group).

Another multiple logistic regression analysis, adjusting for all the 13 independent variables and covariables including those not significant in the Chi-square test statistic of association from two-way table is presented in Table 5. Maternal satisfaction with

postnatal services remained significant (*AOR* = 0.013; 95% *CI* = 0.006, 0.029; $p < .001$). Null hypothesis is rejected and one upholds that there is an association between maternal satisfaction with postnatal services and full childhood immunization status adjusting for full childhood immunization status covariables. The covariables are distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization.

Result Relevant to Research Question 2

2. Is there an association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization)?

Ho_2 There is no association between paternal support and full childhood immunization status controlling for full childhood immunization status covariables (distance to immunization facility, maternal education level, place of delivery, use of antenatal services, family income, place of abode [either urban or rural], and maternal knowledge of the importance of childhood immunization).

Table 2 reveals that 339 (60.5%) participants informed that they had paternal support. Chi-square test of association from two-way table shows that 70.5% (239 of

339) of the respondents with paternal support indicated full childhood immunization status. Table 3 also indicates that paternal support was significantly ($p < .001$) associated with full childhood immunization status.

Paternal support was not significant ($p = .389$) when adjusting for other covariables that were significant in Chi-square test of association from two-way table (see Table 4) in a multiple logistic regression analysis results. It was also not significant ($p = .370$) in another multiple logistic regression analysis adjusting for all the covariables, not minding whether they were significant in the Chi-square test or not. The null hypothesis here is accepted. There is no significant association between paternal support and full childhood immunization status adjusting for full childhood immunization status covariables.

Table 3

Two way Descriptive Characteristics between Selected Variables and Full Childhood Immunization Status among Children Aged 12-23 Months, Owerri Nigeria, March, 2015

	Full childhood immunization status (*N*, %)		
Variable	Yes	No	*p*
Maternal postnatal satisfaction *(n* = 559)			
Yes	271 (96.4)	10 (3.6)	**< .001**
No	52 (29.4)	197 (70.6)	
Paternal support (*n* =560)			
Yes	239 (70.5)	100 (29.5)	**< .001**
No	114 (51.6)	107 (48.4)	
Distance to immunization center (*n* = 560)			
< 1Km	67 (60.4)	44 (39,6)	**.029**
1-2Km	220 (67,3)	107 (39.6)	
>2Km	66 (54.1)	56 (45.9	
Maternal education level (*n* =560)			
Primary or none	79 (40.1)	118 (59.9)	**<.001**
Secondary	66 (65.3)	35 (34,7)	
Professional	62 (77.5)	18 (22.5)	
University	146 (80.2)	30 (19.8)	
Facility of child delivery (n =559)			
None orthodox facility	2 (13.3	13 (86.7)	**< .001**
Orthodox facility	350 (64.3)	194 (35.7)	

(table continues)

	Full childhood immunization status(N,%)		
Variable	Yes	No	p
Number of antenatal visits (*n* =560)			
<3	14 (41,2)	20 (58.8)	**.004**
3	48 (55.2)	39 (44.8)	
>3	291 (66.4)	148 (33.7)	
Family income (XN1,000 per month; *n*= 560)			
<20	63 (44.7)	78 (55.3)	**< .001**
20-150	246 (68.3)	114 (31.7)	
>150	44 (74.6)	15 (25.4)	
Place of residence *(n*= 560)			
Rural	247 (64.5)	136 (35.5)	.170
Urban	106 (59.9)	71 (40.1)	
Maternal knowledge of the importance of childhood immunization (*n*=560)			
Yes	134 (64.1)	75 (35.9)	.683
No	219 (62.4)	132 (37.6)	
Mother's age *(n*= 560)			
<30years	118 (57.8)	86 (42.2)	**.033**
30years	235 (66)	121 (34)	

(table continues)

	Full childhood immunization status (*N,*%)		
Variable	Yes	No	*p*
Maternal knowledge of the importance of immunization documentation (*n*=560)			
Yes	273 (77.8)	78 (22-2)	**<.001**
No	80 (38.3)	129 (61.7)	
Family size (*n*= 560)			
<3	21 (38.3)	33 (61.1)	***.001***
3-4	121 (62.1)	74 (37.9)	
5-6	127 (69.4)	56 (30.6)	
>6	84 (65.6)	44 (34.4)	
Marital status (*n* =560)			
Not married	19 (38)	31 (62)	**< .001**
Married	334 (65.5)	176 (34.5)	

Table 4

Multiple Logistic Regression Analysis between Significant Variables and Full Childhood Immunization Status (N=559)

Variable	Odds ratio (*OR*)	95% Confidence interval	*P*
Maternal satisfaction with postnatal services			
No	0.013	0.006-0.030	**<.001**
Yes	Reference		
Paternal support			
No	0.789	0.460-1.353	.389
Yes	Reference		
Distance to immunization center			
<1Km	1.463	0.678-3.159	.333
1-2Km	1.289	0.686-2.420	.430
>2Km	Reference		
Maternal education level			
Primary or none	1.340	0.585-3.069	.488
Secondary	0.848	0.337-2.131	.725
Professional	0.589	0.208-1.667	.318
University	Reference		
Facility of child's delivery			
Non-orthodox	0.473	0.095-2.351	.360
Orthodox	Reference		
Number of antenatal visits			
<3	0.961	0.324-2.848	.942
3	0.722	0.353-1.476	.372
>3	Reference		

(table continues)

Variable	Odds ratio (*OR*)	95% Confidence interval	*P*
Family income (xN1000 per month)			
<20	0.961	0.324-2.846	.942
20-150	0.722	0.353-1.476	.372
>150	***Reference***		
Maternal age			
<30years	1.177	0.671-2.065	.569
30years and above	Reference		
Maternal Knowledge of the importance of immunization			
No	0.837	0.440-1.593	.589
Yes	Reference		
Family size			
<3	0.256	0.087-0.748	**.013**
3-4	0.564	0.275-1.159	.119
5-6	0.649	0.329-1.280	.212
>6	Reference		
Marital status			
Not married	0.678	0.293-1.567	.363
Married	Reference		

Table 5

Multiple Logistic Regression Analysis between Selected Variables and Full Childhood Immunization Status (N=559)

Variable	Odds ratio(*OR*)	95% Confidence interval	*P*
Maternal satisfaction with postnatal services			
No	0.013	0.006-0.029	**<.001**
Yes	Reference		
Paternal support			
No	0.780	0.453-1.343	.370
Yes	Reference		
Distance to immunization center			
<1km	1.549	0.695-3.449	.284
1-2km	1.334	0.700-2.543	.381
>2km	Reference		
Maternal education level			
Primary or none	1.409	0.610-3.252	.422
Secondary	0.821	0.325-2.072	.676
Professional	0.598	0.210-1.698	.334
University	Reference		
Facility of child delivery			
Non-orthodox	0.417	0.082-2.124	.292
Orthodox	Reference		
Number of antenatal visit			
<3	1.019	0.340-3.047	.974
3	0.713	0.346-1.467	.358
>3	Reference		

(table continues)

Variable	Odds ratio(*OR*)	95% Confidence interval	*P*
Family income(XN1000 per month)			
<20	0.766	0.244-2.411	.649
20-150	0.994	0.370-2.665	.990
>150	Reference		
Place of residence			
Rural	1.059	0.552-2.034	.863
Urban	Reference		
Maternal knowledge of the importance of childhood immunization			
No	0.663	0.374-1.178	.161
Yes	Reference		
Maternal age			
>30 years	1.203	0.683-2.119	.521
30 years and above	Reference		
Maternal knowledge of the importance of immunization documentation			
No	0.840	0.441-1.601	.596
Yes	Reference		
Family size			
<3	0.244	0.082-0.726	**.011**
3-4	0.544	0.258-1.147	.110
5-6	0.675	0.341-1.335	.259
>6	Reference		
Marital status			
Not married	1.536	0.662-3.561	.317
Married	Reference		

Factors Affecting the Maternal Retention of Immunization Documentation

Table 6 shows the report of a Chi-square test of association from two-way table between the maternal retention of immunization documentation and selected characteristics. One hundred and eighteen (58.1%) participants whose ages were less than 30 years indicated maternal retention of immunization documentation. Maternal retention of immunization documentation rate was 64.6% (230 of 356) for mothers whose ages were 30 years and above. Maternal age had no significant (p =.123) association with the maternal retention of immunization documentation.

The maternal retention of immunization documentation rate increased with increase in maternal education level. For mothers in primary school or below category, the maternal retention of immunization documentation rate was 12.2% (24 of 197). The rates were 77.2% (78 of 101), 90% (72 of 80), and 96.2% (175 of 182) for secondary, professional and university categories respectively. Maternal education level was significant ($p < .001$). More than 87% (307 of 351) of respondents who had correct knowledge of the importance of immunization documentation had immunization documentation during the survey data collection. Knowledge of the importance of immunization documentation was significant ($p < .001$). Family income per month had three categories: less than N20, 000, N20,000-N150,000 and above N150,000. In the above N150,000 category, 89.8% (53 of 59) of the respondents retained immunization documentation while 39.7% (56 of 141)of the respondents retained the immunization

documentation in the less than N20,000 category. Family income was significantly ($p <$ .001) associated with the maternal retention of immunization documentation.

Out of the four categories of the respondents in terms of their family size, 70.5% (129 of 183) of those from 5-6 people's category retained immunization documentation. Immunization documentation was retained by 48.4% (62 of 128) of mothers from above six categories. The association between family size and the maternal retention of immunization documentation was significant ($p < .001$). Thirty percent of unmarried participants retained immunization documentation compared to 65.5% (334 of 510) of the married category that retained immunization documentation. Marital status was significant ($p < .001$).

Majority of mothers (71.4% or 242 of339) who selected that they had paternal support to childhood immunization had immunization documentation. Only 48.4% (107 of 221) of women without reasonable paternal support presented immunization documentation. Maternal retention of immunization documentation was statistically significant ($p < .001$) with paternal support. Among the respondents, 92.9% (261 of 281) shared that they had both maternal satisfactions with postnatal services and immunization documentation for their children. The maternal satisfaction with postnatal services was significant ($p < .001$).

The next variable row was maternal knowledge of the importance of childhood immunization. About 62.3% (149 of 209) of mothers who demonstrated real knowledge

of the importance of childhood immunization indicated that their children's immunization documentations were retained. Maternal knowledge of the importance of childhood immunization was statistically significant ($p < .001$). One of the variables under investigation was place of residence in terms of urban or rural. About 68.4% (121 of 177) of the respondents from urban areas presented their children's immunization documentation. The association between place of residence and the maternal retention of immunization documentation was significant ($p = .027$).

Respondents who lived at a distance 1-2Km away from the immunization center (63.6% or 208 of 327) dominated others in the presentation of immunization documentation. The maternal retention of immunization documentation for other categories of respondents were 60.4% (67 of 111), 60.7% (74 of 122) for less than 1Km and more than 2Km distance to immunization centers respectively. Distance to immunization center was not statistically significant ($p = .757$). Majority of women who made more than three antenatal clinic visits during their last pregnancy (64.5% or 283 of 449) had immunization documentation. However, there was no significant association ($p = .078$) between the number of antenatal clinic visits and the maternal retention of immunization documentation. Among the 544 respondents who delivered their babies at orthodox facilities, 63.1% ($n = 343$) of them indicated maternal retention of immunization documentation. Place of child delivery was significantly associated ($p = .021$) with the maternal retention immunization documentation.

Table 7 indicates multiple logistic regression results between selected variables that were significant in the Chi-square test of association from two-way table and the maternal retention of immunization documentation. The covariables in the table are ten. The overall percentage of correct classification of intercept only model is 62.3% while step 1 model indicates 91.2% correct classification. The Hosmer-Lemeshow test was not significant (p =.924), meaning the model fits the data. The reported Nagelkerke R^2 is .783 and test for model coefficient was significant (p < .001).

Respondents who had primary education or below had lower odds (*AOR* =0.025; 95% *CI* =0.009, 0.069; p < .001) of the maternal retention of immunization documentation than those with university education (reference group). Participants with secondary education had lower odds (*AOR* = 0.256; 95% *CI* =0.088, 0.774; p =.012) of the maternal retention of immunization documentation than those with university education (reference group). Maternal education had a significant association with the maternal retention of immunization documentation adjusting for other ten covariables. Respondents from families of three to four persons had higher odds (*AOR* = 2.801; 95% *CI* = 1.106, 7.090; p =.030) of the maternal retention of immunization documentation than those from families of above six persons. Family size had statistically significant association with the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables.

Mothers who indicated that they were not satisfied with postnatal services had lower odds (*AOR* = 0.118; 95% *CI* = 0.056, 0.249; $p < .001$) of the maternal retention of immunization documentation than those who indicated maternal satisfaction with postnatal services (reference group). Maternal satisfaction with postnatal services was significantly associated with the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables. Participants without sound knowledge of the importance of immunization documentation had lower odds (*AOR* =0.177, 95% *CI* =0.088, 0.359; $p < .001$) of the maternal retention of immunization documentation than those with real knowledge of the importance of immunization documentation (reference group). Maternal knowledge of the importance of immunization documentation was significantly associated with the maternal retention of immunization documentation adjusting for the maternal retention of immunization documentation covariables.

The odds of other covariables were not statistically significant. They were maternal knowledge of the importance of childhood immunization (p =.060), family income (p =.999 for less than N20, 000 per month, p =.660 for N20, 000 – N150, 000 per month), and marital status (p =.272). Paternal support (p = .434), place of residence (p =.885), and facility of child's delivery (p =.532) were also insignificant.

Association between all the independent variables and covariables including those significant or not in the Chi-square test statistic of association and the maternal retention

of immunization documentation is shown in Table 13. The overall percentage of correct classification of intercept only model is 62.3% while step 1 model indicates 91.6% correct classification. The Hosmer-Lemeshow test was not significant (p =.812), meaning the model fits the data. The reported Nagelkerke R^2 is 0.787.

When compared to the reference group of participants with university education, the primary and lower level education group (*AOR* = 0.024; 95% *CI* = 0.009, 0.065*; p* < .001) and secondary education group (*AOR* = 0.243; 95% *CI* =0.081, 0.726; *p* = .011) had lower odds of the maternal retention of immunization documentation. Maternal education level had a significant association with the maternal retention of immunization documentation controlling for other covariables. Mothers without knowledge of immunization documentation importance had significantly lower odds (*AOR* = 0.167; 95% *CI* =0.082, 0.341; *p* < .001) of the maternal retention of immunization documentation than mothers with real knowledge of the importance of immunization documentation (reference group). Respondents from household with five to six persons had higher odds (*AOR* =.1.321; 95% *CI* =1.246, 8.378; *p* =.016) of the maternal retention of immunization documentation than those from families of more than six people (reference group). Maternal satisfaction with postnatal services was significant (*AOR* = 0.114, 95% *CI* =0.053, 0.243; *p* < .001). Also, significant was maternal knowledge of the importance of childhood immunization (*AOR* = 0.477, 95% *CI* =0.233, 0.976; *p* =.042). Non-significant covariables were maternal age, family income, marital status, paternal

support, place of residence, distance from immunization center, number of antenatal clinic visits and facility of child's delivery. Maternal knowledge of the importance of childhood immunization was not significant in Table 7. It then implies that the number of significant variables increased by one in this model.

Result Relative to Research Question 3

3: Is there an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_3: There is no association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

Maternal education level of the respondents is shown in Table 1. No education (illiterate) category among the participants was 5.2% (n =29), Primary 31.4% (n =176), Secondary 18% (n =101), Professional 14.3% (n =80), and University 32.5% (n =182). The maternal retention of immunization documentation (immunization card) was 62.3% (n =349) among the survey respondents.

Maternal education was significantly associated ($p < .001$) with the maternal retention of immunization documentation in the Chi-square test of association from two-way table (see Table 6). Multiple logistic regression analysis results between significant

variables in the Chi-square test from two-way table and the maternal retention of immunization documentation is shown in Table 7. Here respondents with primary education or less (*AOR* =.0025; 95% *CI* = 0.009, 0.069; $p < .001$) and respondents with secondary education (*AOR* = 0.256; 95% *CI* =0.088, 0.744; p =.012) had lower odds of maternal retention of immunization documentation than those with university education (reference group). Another multiple logistic regression results that adjusted for all the covariables shows similar estimate: ($p < .001$) for primary or less category, (p =.011) for secondary school category (see Table 13). There is enough evidence to reject the null hypothesis based on these analyses and results. Thus, maternal education level was significantly associated with the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

Result Relative to Research Question 4

4: Is there an association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_4: There is no association between maternal age and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

Seven respondents (1.3%) were less than 20 years old while 35.2% (*n* =197) of the respondents were between 20 and 29 years old. Also, 63.6% (*n* =356) of the respondents were 30 years old and above (see Table 1). In a Chi-square test of association from two-way table result (see Table 6), maternal retention of immunization documentation was practiced by 58.1% of respondents below the age of 30 years old. In the 30years old and above class, 64.6% of them revealed maternal retention of immunization documentation (immunization card). Maternal age was not significantly associated (*p* =.123) with the maternal retention of immunization documentation. Table 8 shows a multivariate logistic regression analysis results that adjusted for all covariables whether significant in the Chi-square test of association from two-way table or not. Maternal age was not significant (*p* =.663). There is no evidence to reject the null hypothesis. Accordingly, there is no significant association between maternal age and the maternal retention of immunization documentation adjusting for the maternal retention of immunization documentation covariables.

Result Relative to Research Question 5

5. Is there an association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income)?

Ho_5: There is no association between maternal knowledge of the importance of immunization documentation and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables (marital status, family size, and family income).

Dominant response by the participants demonstrated that 62.7% of them had adequate knowledge of the importance of immunization documentation (Table 1). The two-way table indicates that 87.5% of the participants with real knowledge of the importance of immunization documentation were able to present immunization documentation during survey data collection. Chi-square test of association from two-way table (Table 6) indicates that maternal knowledge of the importance of immunization documentation was significantly associated ($p < .001$) with the maternal retention of immunization documentation (immunization card).

Table 7 is a multiple logistic regression analysis results between characteristics that were significant in the Chi-square statistic test of association from two-way table. Respondents without the real knowledge of the importance of immunization documentation had lower odds (AOR =0.177; 95% CI =0.088, 0.359; $p < .001$) of the maternal retention of immunization documentation compared with respondents with real knowledge of the importance of immunization documentation (reference group). The results of another multiple logistic regression analysis using all the covariables, regardless of whether such were significant or not in the Chi-square test of association

from two-way table are shown in Table 13. In this table, maternal knowledge of the importance of immunization documentation was still significant (*AOR* = 0.167; 95% *CI* = 0.082, 0.341; $p < .001$). Consequently, evidence exists to reject the null hypothesis. Maternal knowledge of the importance of immunization documentation was significantly associated with the maternal retention of immunization documentation adjusting for the maternal retention of immunization documentation covariables (marital status, family income, and family size).

Table 6

Two Way Descriptive Characteristics of Selected Variables and the Maternal Retention of Immunization Documentation, Owerri Nigeria, November,2014

	Maternal retention of immunization documentation (*n*, %)		
Variable	Yes	No	*P*
Maternal age (*n* =559)			
Less than 30years	118(58.1)	85 (41.9)	.123
30years and above	230 (64.6)	126 (35.4)	
Maternal education level (*n* =560)			
Primary or below	24 (12.2)	173 (87.8)	***<.001***
Secondary	78 (77.2)	23 (22.8)	
Professional	72 (90)	8 (10)	
University	175 (96.2)	7 (3.8)	
Maternal knowledge of the importance of immunization documentation (*n* =560)			
Yes	307 (87.5)	44 (12.5)	***<.001***
No	42 (20.1)	167 (79.9)	
Family size (*n* =560)			
<3	25(46.3)	29(53.7)	**<.001**
3-4	133(68.2)	62(31.8)	
5-6	129(70.5)	54(29.5)	
>6	62(48.4)	66(51.6)	
Family income{XN1000 per month}(*n* =560)			
<20	56(39.7)	85(60.3)	**<.001**
20-150	240(66.7)	120(33.3)	
Above 150	53(89.8)	6(10.2)	

Marital status (*n* =560)			
Not married	15(30)	35(70)	**<.001**
Married	334(65.5)	176(34.5)	
Paternal support (*n* =560)			
Yes	242(71,4)	97(28.6)	**<.001**
No	107(48.4)	114(51.6)	
Maternal satisfaction with postnatal services (*n* = 560)			
Yes	261(92.9)	20(7.1)	**<.001**
No	88(31.5)	191(68.5)	
Maternal knowledge of the importance of childhood immunization (*n* = 560)			
Yes	149(62.3)	60(37.7)	**<.001**
No	200(57.5)	151(43)	
Place of residence (*n* = 560)			
Rural	228(59.5)	155(40.5)	**.027**
Urban	121(68.4)	56(31.6)	
Distance to immunization center (*n* = 560)			
<1Km	67(60.4)	44(39.6)	.757
1-2Km	208(63.6)	119(36.4)	
>2Km	74(60.7)	48(39.3)	
Number of antenatal visits (*n* = 560)			
<3	16(47.1)	18(52.9)	.078
3	50(57.5)	37(42.5)	
>3	283(64.5)	156(35.5)	
Facility of child's delivery *(* *n* = 559)			
Non-orthodox	5(33.3)	10(66.7)	**.021**
Orthodox	343(63.1)	201(36.9)	

Table 7

Multiple Logistic Regression Analysis between Significant Variables and the Maternal Retention of Immunization Documentation (*N*=559)

Variable	Odds ratio(*OR*)	95% Confidence interval	*P*
Maternal education level			
Primary or none	0.025	0.009 - 0.069	**<.001**
Secondary	0.256	0.088 - .0744	**.012**
Professional	0.503	0.151 – 1.672	.262
University	Reference		
Maternal knowledge of the importance of childhood immunization			
No	0.507	0.250 – 1.028	.060
Yes	Reference		
Family size			
<3	2.711	0.703 – 10.453	.148
3-4	2.801	1.106 – 7.090	**.030**
5-6	3.212	1.259 – 8.193	**.015**
>6	Reference		
Family income(XN1000 per month)			
<20	1.001	0.210 – 4.768	.999
20-150	0.729	0.179 – 2.970	.660
>150	Reference		
Marital status			
Not married	0.528	0.169 – 1.650	.272
Married	Reference		

(table continues)

Paternal support			
No	0.753	0.370 – 1.533	.434
Yes	Reference		
Maternal satisfaction with postnatal services			
No	0.118	0.056 - 0.249	**<.001**
Yes	Reference		
Place of residence			
Rural	1.077	0.485 – 2.394	.855
Urban	Reference		
Facility of child's delivery			
Not orthodox	1.698	0.323 – 8.932	.532
Orthodox	Reference		
Maternal knowledge of the importance of immunization documentation			
No	0.177	0.088 - 0.359	**<.001**
Yes	Reference		

Table 8

Multiple Logistic Regression Analysis between Selected Variables and the Maternal Retention of Immunization Documentation (n = 559)

Variable	Odds ratio (**OR**)	95% Confidence interval	*P*
Maternal age			
<30years	0.849	0.406-1.774	.663
30years and above	Reference		
Maternal education level			
Primary or none	0.024	0.009-0.065	**<.001**
Secondary	0.243	0.081-0.726	**.011**
Professional	0.495	0.147-1.662	.255
University	Reference		
Maternal knowledge of the importance of immunization documentation			
No	0.167	0.082-0.341	**<.001**
Yes	Reference		
Family size			
<3	2.506	0.576-10.909	.221
3-4	2.469	0.892-6.832	.082
5-6	3.231	1.246-8.378	**.016**
>6	Reference		
Family income(XN1000 per month)			
<20	0.962	0.199-4.650	.961
20-150	0.711	0.172-2.940	.638
>150	Reference		
Marital status			
Not married	0.447	0.140-1.428	.174

(table continues)

Variable	Odds ratio	95% Confidence interval	*P*
Married	Reference		
Paternal support			
No	0.754	0.363-1.567	.450
Yes	Reference		
Maternal satisfaction with postnatal services			
No	0.114	0.053-0.243	**<.001**
Yes	Reference		
Maternal knowledge of the importance of childhood immunization			
No	0.477	0.233-0.975	**.042**
Yes	Reference		
Place of residence			
Rural	1.084	0.468-2.510	.850
Urban	Reference		
Distance to immunization center			
<1km	0.888	0.313-2.517	.822
1-2km	0.701	0.296-1.659	.419
>2km	Reference		
Number of antenatal visits			
<3	2.476	0.689-8.904	.165
3	1.211	0.495-2.966	.675
>3	Reference		
Facility of child's delivery			
Non-orthodox	1.272	0.243-6.672	.776
Orthodox	Reference		

Summary of Findings

Maternal satisfaction with postnatal services appears to be an important predictor of full childhood immunization status. Maternal education and maternal knowledge of the importance of immunization documentation were significant predictors of the maternal retention of immunization documentation. Multiple logistic regression results indicate that mother whose family size was less than three had significantly higher odds of full childhood immunization status than those whose family sizes were more than six. It also indicates that moderately populated families (3-4 and 5-6) had higher odds of the maternal retention of immunization documentation than those whose family sizes were more than six. Mothers without paternal support had lower odds of the maternal retention of immunization documentation than mothers with paternal support.

The researcher concludes that the maternal satisfaction with postnatal services has been shown to be associated with full childhood immunization status, having reviewed the data in the light of the hypotheses. He also finds that maternal education level and maternal knowledge of the importance of immunization documentation were associated with the maternal retention of immunization documentation.

Chi-square test of association from two-way table advances that maternal satisfaction with postnatal services, paternal support, distance to immunization center; maternal education level and facility of child's delivery were associated with full

childhood immunization status. Other significant covariables were the number of antenatal clinic visits, family income, maternal age, maternal knowledge of the importance of immunization documentation, family size and marital status. Place of residence and maternal knowledge of the importance of childhood immunization were not significant.

Similarly, Chi-square test of association from two-way table indicates that the following covariables stated below were associated with the maternal retention of immunization documentation: maternal education, maternal knowledge of the importance of immunization documentation, family size, family income, marital status, and paternal support, maternal satisfaction with postnatal services, maternal knowledge of the importance of childhood immunization, place of residence, and facility of child's delivery. Distance from immunization center, number of antenatal visits, and maternal age were not associated with the maternal retention of immunization documentation. In Chapter 5, I will present interpretation and discussion of findings, social change implications of this study and recommendations for professional decisions and future studies.

Chapter 5: Discussion, Conclusions, and Recommendations

Overview

In this chapter I will discuss and interpret the findings presented in Chapter 4. I conducted a population-based quantitative cross-sectional survey to address knowledge gap on the influence of multilevel factors on childhood immunization status and the maternal retention of immunization documentation in Owerri. Nigeria remains one of the four countries in the world where many of non-immunized children are living with attendant high mortality from vaccine-preventable childhood diseases (Antai, 2009). To the best of my knowledge, no prior research was directed to childhood immunization status in Owerri or focused on the impact of multilevel factors on childhood immunization in the area. Finally, I will present positive social change implication of the study, recommendation for programmatic action and future research, limitation of the study and the conclusion in this chapter.

Summary of Key Findings

Here I addressed five research questions, considering factors such as maternal satisfaction with postnatal services and paternal support in relation to full childhood immunization status. Others are maternal education level, maternal age, and maternal knowledge of the importance of immunization documentation as they relate to the maternal retention of immunization documentation. Findings have shown that maternal satisfaction with postnatal services is a predictor of full childhood immunization status.

Also, maternal education level and maternal knowledge of the importance of immunization documentation are predictors of the maternal retention of immunization documentation. There is no significant association between paternal support and full childhood immunization status. Finally, it was revealed that there appears to be no association between maternal age and the maternal retention of immunization documentation.

Interpretation of Findings

The survey data have shown that full childhood immunization status measured either through immunization documentation or maternal recall is 63% while retention of immunization documentation is 62%. These measures are similar to those of other studies in the southern part of Nigeria. A study in Edo State, Nigeria indicated 60% full childhood immunization coverage and 55% maternal retention of immunization documentation rate (Odusanya et al., 2008). Another study in Niger Delta States of Nigeria had full childhood immunization rate at 68.5% (Oyo-Ita et al., 2012). The childhood immunization rate is yet to reach the World Health Organization target of 80% coverage at district level (WHO, 1996). This situation predisposes the communities to high morbidity and mortality from vaccine-preventable childhood diseases since the resulting herd immunity in the areas will remain low.

The need for proper preservation of immunization documentation cannot be overemphasized in view of its importance to the entire immunization program.

Immunization documentation retention rate is one of the prime indexes of program performance evaluation (UNICEF, 2008). It is paramount for assessing immunization coverage, the dropout rate, and validity of immunization (Drummer et al., 2012; Murray et al., 2003). Immunization documentation enables health workers to ascertain which immunization is due, already given or outstanding. In some occasions health workers who are apprehensive of risk of vaccine reaction may not want to give immunization to children whose mothers could not present the immunization documentation at the immunization center (Sanou et al., 2009). The rate of immunization documentation retention recorded in this study cannot reasonably make the desired impact on immunization program assessment, revision, improvement and continuity (Vandermeulen et al., 2008).

Maternal Satisfaction with Postnatal Services and Full Childhood Immunization Status

Among the survey respondents, 50.2% (n =281) informed that they were satisfied with postnatal services. Ninety-six percent of participants who were satisfied with postnatal services had children with full childhood immunization status. Maternal satisfaction with postnatal services is statistically significantly associated (AOR = 0.013; 95% CI =.006, .030; p < .001) with full childhood immunization status. The outcome of this study is consistent with that of treatment satisfaction and adherence to osteoporosis treatment (Barrett-Connor et al., 2012). It is also similar to the study on patients'

satisfaction and adherence to anti-hypertensive treatment (Zyoud et al., 2013). Healthcare client's satisfaction has recently become an index of assessing the performance of health services (Otani et al., 2012). Consequently, postnatal services satisfaction is a system factor that can inform the performance of maternal and child health services and indeed childhood immunization services.

Childhood immunization demand and utilization depends on the choice of the parents and satisfaction is an important determinant of this choice. Factors that determine satisfaction with health services are the environment of the service facility and level of communication between service provider and client. Other important factors are contraindication of services, staff attitude and the rapidity of care (Bleich et al., 2009). Part of the reasons for avoiding childhood immunization are attitude of the service providers, long waiting period and poor communication by the service providers (Adeyinka et al., 2009). A close observation of many of the government immunization centers shows that the physical infrastructures are in need of improvement. Motivating mothers to come for childhood immunization is crucial to the optimal utilization of the childhood immunization services. Harnessing health service system factors including maternal satisfaction with postnatal services may go a long way to improving full childhood immunization status.

Paternal Support and Full Childhood Immunization Status

The proportion of respondents who had good paternal support (achieving mean score of four and above in the Likert questions) was 60.5% out of which 70.5% of them had children with full immunization status. Paternal support is significant ($p < .001$) in the Chi-square test of association from a two-way table. However, in a multivariate logistic regression analysis, Paternal support was not significant ($p = .380$). The conclusion then is that there is no statistical significant association between paternal support and full childhood immunization status adjusting for full childhood immunization status covariables. This study outcome is not consistent with other studies on this variable in other related services such as child development, well-being, infant breastfeeding and maternal parenting stress (Ball, & Moselle, 2007; Dashti et al., 2010; Ghosh et al., 2010). In many cultures, the cooperation between parents is essential for maternal and child healthcare service utilization including adolescents' immunization (Vandermeulen et al., 2008). Considering the outcome in the light of other studies in related areas, I would suggest that the influence of paternal support to full childhood immunization status be subjected to further investigation.

Maternal Education Level and the Maternal Retention of Immunization Documentation

The formal educational attainment of the participants was classified into the following groups: none (3.8%); primary (31.4%); secondary (18%); professional

(14.3%); and university (32.5%). Percentage of participants that indicated full childhood immunization was 12.2% for primary or below, 77.2% for secondary, 90% for professionals and 96.2% for university graduates. In the Chi-square test of association from a two-way table, maternal education level was significant ($p < .001$). In a multivariate logistic analysis, the respondents with lower education had lower odds of the maternal retention of immunization documentation compared with those with higher education level. The estimates were ($AOR = 0.025$; 95% $CI = .0009, .069$; $p < .001$) for primary education or less, and ($AOR = 0.256$; 95% $CI = .088, .744$; $p = 0.012$) for secondary education group. It is, therefore, apparent that there is an association between maternal education level and the maternal retention of immunization documentation controlling for the maternal retention of immunization documentation covariables. Study outcome here supports the outcome of similar studies on full childhood immunization and maternal utilization of health services in Nigeria, Ethiopia, Kenya and India (Abuya et al., 2011; Etana & Deressa, 2012; Odusanya et al., 2008; Singh, Rai, et al., 2012). However, similar studies in Canada and Somaliland were not consistent with this finding. In Somaliland, there was no association between maternal education and full childhood immunization (UNICEF, 2008). In Canada, a negative relationship was found between maternal education and full childhood immunization (Drummer et al., 2012). The result of the research in Canada might be due to the influence of anti-vaccination groups in the developed world on educated populace that has higher tendency to access the group's

information. For the Somaliland study, the sampling size ($N = 280$) might be too small for this kind of study, and consequently may lack appropriate statistical power.

The outcome of this study has reinforced the need for adequate girl-child education in the developing countries. This is important because maternal education is showing influence on the child and family welfare, and family income. Education level of an individual determines the individual's predisposition to seek information, process, understand and utilize it positively. Education level may also influence how orderly an individual would be. All these are attributes that would have influenced the relationship between maternal education and the maternal retention of immunization documentation.

Maternal Age and the Maternal Retention of Immunization Documentation

The respondents were divided into three classes according to their ages. The classes are below 20 years old, 20-30 years old, and above 30 years old. Majority of the respondents (63.6%) were above 30 years old category, and 35.2% were 20-30 years old group. The least group was the below 20 years old category (1.3%). Maternal age has no significant association with the maternal retention of immunization documentation. This finding is contrary to the outcome of studies in India that assessed the relationship between maternal age and maternal utilization of health services. The Indian studies advanced that maternal age influences full maternal tetanus immunization and the maternal utilization of maternal and child health services (Singh, Pallikadvath, et al., 2012; Singh, Rai et al., 2012). Socially, it is recognized that age group determines

expected behavior in any human society. Consequently, the reason for the outcome of the study in this case cannot be fully explained.

Maternal Knowledge of the Importance of Immunization Documentation and the Maternal Retention of Immunization Documentation

Among the participants of the study, 351(62.7%) had real knowledge of the importance of immunization documentation. Three hundred and seven (87.5%) persons of this group of participants showed their children immunization card at survey data collection period. Maternal knowledge of the importance of immunization documentation was significantly associated with the maternal retention of immunization documentation. This outcome is consistent with the result of other studies that showed association between maternal knowledge of the importance of childhood immunization and full child immunization status (Abdulraheem et al., 2011; Etana & Deressa, 2012; Odusanya et al., 2008). The finding underpins the importance of message and information sharing in any project including universal childhood immunization project. Community health projects such as children immunization must be client or community oriented (Sanou et al., 2009). It is through adequate provider-client communication that the client realizes the importance of the project. Cognitive realization of the importance of immunization documentation will enable mothers prioritize the safe keeping of this documentation among other personal and domestic competing factors. Possession of appropriate information can influence value system and human behavior.

Interpretation in Relation to the Theory

The outcome of this study is supported by the social ecological theory. It concludes that the behavior is impacted and impacts interconnected factors of intrapersonal, interpersonal, physical environment, socio-cultural environment and social policy (Golden & Earp, 2012; Sallis, Owen, & Fisher, 2008). Going by the social ecological theory, the association between full childhood immunization status (behavioral factor) and maternal satisfaction with postnatal services (social policy factor) is expected. The indicated association between maternal education level, maternal knowledge of the importance of immunization documentation (intrapersonal factors) and the maternal retention of the immunization documentation (behavioral factor) is also consistent with the essence of social ecological theory. However, the identified relationship between paternal support and full childhood immunization status; maternal age and the maternal retention of immunization documentation do not fit the social ecological model.

Implications of the Study

To the best of my knowledge, this is the first population-based cross-sectional survey on the impact of multilevel factors on childhood immunization status in Owerri. The study outcome may, therefore, play a significant role in the expanded program on immunization planning, implementation, evaluation and sustenance in Owerri and other cities with similar characteristics in Nigeria.

It is clear that childhood immunization status in Nigeria and some other developing countries remains below optimal level, despite enormous resources always directed towards evolving innovative strategy for EPI implementation. The findings of this study will contribute to the much-expected alternative approaches to take advantage of EPI to reduce the alarming public health burden in Nigeria due to childhood vaccine-preventable diseases.

Outcome of this study has implication on the influence of maternal satisfaction with postnatal services on full childhood immunization status. It implies that efforts should be made to make EPI and postnatal services mothers and communities friendly to stimulate and sustain the demand and utilization of EPI and other related services. Findings have shown that the rate of the maternal retention of immunization documentation is poor. Consequently, maternal self-report of child's immunization history becomes central to the measurement of childhood immunization coverage in program evaluation and research. The apprehension of probable recall bias trails the consideration for this measurement approach. Inabilities of mothers to present evidence of immunization documentation at the immunization centers influence service delivery negatively. It is then worthwhile to invest in EPI integrated projects that will improve the maternal retention of immunization documentation. Subsequently, acquisition and the deployment of a central immunization registry with electronic reminder system is needed. Similarly, integrated childhood immunization information/education program targeted at

illiterate and poorly educated mothers at maternal and child health clinics and community levels is imperative. The last recommendation is made against the backdrop of the revealed relationship between maternal education level, knowledge of the importance immunization of documentation and the maternal retention of immunization documentation.

Implication for Positive Social Change

The implication for positive social change in the findings rests on the knowledge of the revealed relationship between maternal satisfaction with postnatal services and full childhood immunization status. EPI policy makers should now consider maternal satisfaction with postnatal services as an important component of universal childhood immunization project. In the same vein, the Federal Government and its funding partners through the Federal Ministry of Health and The Primary Health Care Development Agency should appreciate the importance of system factors in the realization of immunization project objectives.

Doctors, Public Health Nurses, and other healthcare professionals should act on the understanding that maternal education level and maternal knowledge of the importance of immunization documentation influence the maternal retention of immunization documentation. To this end, they should create appropriate comprehensive immunization information/education package for mothers especially the illiterate and poorly educated mothers. Every health service encounter should be utilized for this

purpose. This may stimulate community demand for childhood immunization and cause an increase in childhood immunization coverage rate in Owerri. The resultant increase in childhood immunization coverage rate will reduce morbidity, mortality and disabilities due to childhood vaccine-preventable diseases in Owerri (WHO, 2013).

Limitations of the Study

The primary source of data for this study was self-report of socio-demographic characteristics, child's immunization history, and maternal perception of the childhood immunization program. Self-report has a tendency to introduce recall bias. Mothers may also want to answer according to what they think are socially acceptable and introduce information bias. These conditions can either cause overestimation or underestimation of effects. For a mother to report events that had occurred after one year depends on her perception of such event. Obviously, it is not likely that the participants will have the same perception concerning childhood immunization. It might also be possible for mothers not to know precisely which immunization their children have received and the one outstanding. Again I dichotomized responses/scores for measuring maternal satisfaction with postnatal services, paternal support, maternal knowledge of the importance of childhood immunization and maternal knowledge of the importance of immunization documentation. The standard for the determination of code "1" may be considered too high to exclude few weak probable positive responses.

This shortcoming notwithstanding, maternal recall has been shown to be a reliable measure of childhood immunization status (Burton et al., 2009; Sanou et al., 2009). In this study also, I did not consider verifying the validity of the immunization received by children. Though these limitations exist, the study has given us a better understanding of the predictor of full childhood immunization status in Owerri, Nigeria.

Recommendation for Further Study

The realization that maternal satisfaction with postnatal services is positively associated with full childhood immunization status provokes further studies. It calls for the study of other immunization (maternal and child health) services factors that influence maternal satisfaction with postnatal services. The outcome of the study on paternal support and full childhood immunization status is not similar to the outcome of other studies on related dependent variables. Further investigation is needed to confirm or disregard this study outcome in Owerri.

Retention of immunization documentation is one of the cardinal expectations of EPI in view of its importance to the program performance evaluation and sustenance. However, the study has shown that the maternal retention of immunization documentation is poor. The study also revealed that level of maternal education and knowledge of the importance of immunization documentation drive the maternal retention of immunization documentation. It then becomes imperative to research into

factors that influence the maternal retention of immunization documentation among less educated and literate mothers.

Conclusion

Universal childhood immunization introduced through EPI is acknowledged as the most efficient public health innovation for the prevention of vaccine-preventable childhood diseases. Consistent with many other studies in the developing countries (Oyo-Ita et al., 2012; UNICEF, 2008), full childhood immunization status and the maternal retention of immunization documentation rate are below the expected target. Findings have shown that maternal satisfaction with postnatal services predicts full childhood immunization status. The study also shows that maternal education level and maternal knowledge of the importance of the immunization documentation are predictors of the maternal retention of immunization documentation.

Research is needed to investigate health system components that determine maternal satisfaction with postnatal services in Owerri. Outcome of such study may identify in concrete terms the system factors that will be given more attention by the policy makers and nurses, doctors and public health officers to improve full childhood immunization status. Since maternal education level and maternal knowledge of the importance of immunization documentation drive the maternal retention of immunization documentation, efforts to improve immunization documentation retention rate should focus on illiterate and poorly educated mothers. A qualitative inquiry is necessary to

explore the illiterate and poorly educated mothers' perception about immunization documentation. Research should also find out what should be done to enable them retain immunization documentation.

Childhood immunization project planning, implementation, evaluation and research should focus contextual views of the program in the light of social ecological model. In other words, the project must be fashioned within the social ecological enunciated theory of interaction between multilevel factors of behavioral, intrapersonal, interpersonal, physical environment, community, and social policy factors. One could argue that the time has come for the development of a central immunization registry with electronic reminder system to improve both full childhood immunization coverage and immunization documentation.

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Appendix A: Literature Matrix

Table A1.

Full Immunization Coverage and Reasons for Non-Immunization

	Citation	Purpose	Method	Results
1	Ba'amer (2010)	The study was to uncover immunization coverage and reasons for un-immunization in Al-Mukalla district, Yemen among 12-23 months children	The method is a cross sectional survey study that is strictly fashioned according to WHO's EPI - 30 cluster survey standard format. Sample size was determined based on 95% confidence interval, 10% precision, expected coverage 50-95%, and design effect 2. 210 children (7 per cluster) were selected. EPI survey forms were employed to gather data through interviewer administered questionnaire. EPI info software was used for data entry and analysis (coverage rat	Full immunization coverage 82.4%. partially immunized 12.4%, No immunization 5.2%. Dropout rate 3.1% for DTP_1 to DTP_3, and 0.5% between DTP_1 to measles vaccine. Card retention 66.7% - Long distance to vaccination facility Lack of information were main reasons for none vaccination. NOTE: - Full vaccination, partial & no vaccination was defined, valid dose too. (table continues)

		computation). Feb. 9 to March 15, 2006 was period of data collection.	Benefit of local immunization survey: identifying under vaccinated sub-groups Designing how to improve vaccination program performance. -Limitation: Vaccinaton recorded correctly in the card Mother/caregivers recall Population estimation based on administrative record.

Table A2

Disparity in Full Childhood Immunization

	Citation	Purpose	Method	Result
2	Singh (2013)	To assess gender, regional and rural-urban disparity in full immunization coverage in India.	Three rounds of Indian National Family Health Survey (NFHS) 1992-2006 were the sources of data for this study. Dependent variable was full childhood immunization while demographic variables were the independent variables. Chi-Square test of difference and binary logistic regression was used to analyze data.	- Highest GIR increase is in the West Region from 95 in 1992 to 112 in 2006 - URIR increased in Maharashtra (43), Madhya Pradesh (33) At national level GIR and URIR declined (176 to 157) and (110 to 105) respectively from 1992 to 2006 . + Limitation: Maternal recall may i ntroduce bias in the data.

Table A3

Full Immunization Coverage, Timeliness and Demographic Determinants

	Citation	Purpose	Method	Results
3	Vandermeulen et al. (2008)	To determine vaccination coverage, timeliness and socio demographic determinants of vaccination among adolescents in Flanders, Belgium.	Cross sectional survey. WHO 2 stage sampling technique was used to select 1500 participants for the study. Questionnaire on demographic factors were completed per participant and immunization status and date of immunization was copied from the cards. Univariate and multivariate logistic analysis were used to analyze data	Full immunization 58.1% 31.8% document retention Birth order ($P< 0.01$) Family size ($P< 0.05$) Positive association with father's full employment ($P<0.01$)

Table A4

Determinants of Full Childhood Immunization.

Citation	Purpose	Method	Results
Antai (2009)	To conduct multivariable analyses of multi level determinants of full immunization in Nigeria.	Data were extracted from National Demographic and Health Survey data of 2003. Child and mother data were analyzed nested in community data using multiple regression analysis. Multi stage probability sampling method was used to select subjects from the six geopolitical zones in the country for the survey	-Birth order negatively influence (*OR* = 0.51; 95% *CI:*0.33 – 0.79) - Igbo (*AOR* = 1.66, 95% *CI*: 1.15 -2.41); Yoruba (*AOR* = 1.90, 95% *CI*: 1.29 -2.81) Others (*AOR* = 1.68, 95*CI*: 1.22 – 2.23); Hausa/Fulani (*AOR* 0.62, 95*% CI*:0.40 - 0.96). - South-South (*OR* = 0.36, 95% *CI*: 0.18, 0.73) and South East region (*OR*=0.48, 95%*CI*:0.26, 0.87) are less likely to have full immunization than South West region.

Table A5

Maternal and Childhood Immunization Coverage

Citation	Purpose	Method	Results
United Nations International Children Emergency Fund [UNICEF] (2008)	To understand immunization coverage rate among children and women in Somaliland and examine reasons for failure to utilize immunization services. The study also covered rate of utilization of vitamin A supplements.	Cross-sectional survey. WHO's 30-cluster sampling technique was utilized to select participants. The participants are 280 mothers of children ages between 12 months and 23 months. WHO standard EPI cluster survey forms were used to collect data from participants. WinCosas and EpiInfo softwares were used for data entry and computation of rates.	Reasons for failure to immunize: - Lack of vaccine (37%) - Lack of awareness (10%) - Distance (8%) - Short distance and availability of transportation means favored urban full immunization (29%), rural (22%) Maternal education not significant

Table A6

Determinants of Complete DTP Immunization, Partial, Missed, and Full Childhood Immunization

Citation	Purpose	Method	Result
/			
Usman et al. (2010)	To determine factors influencing DTP competition after taking the initial dose (DTP1)	A cohort study involving 378 mother – child pair with 90days follow up from DTP1. To test the association between each independent variable and immunization status (dependent variable) univariate log-binomial regression analysis was used. Multivariate log-binomial regression analysis was used to assess the association between independent variables and immunization status adjusting for other variables.	DTP/OPV– Age ≤ 60 days at start (*Adj RR* 1.39, 95%*CI*: 1.06 – 1.82) - Living at ≤10 minutes walking distance to facility *Adj RR* 1.31; 95%*CI*:1.04 – 1.66) - Income (*Adj RR*= 1.76, 95% *CI*: 1.16 -2.65) /HBV vaccine at 6, 10 & 14 weeks and measles vaccine at 9 months.
			(table continues)

Citation	Purpose	Method	Result
Odusanya, Alufohai, Meurice & Ahonkhai (2008)	To determine childhood immunization coverage in relationship to seven out of eight recommend childhood vaccines in Sabongidda – Ora, Edo State, a community with GlaxoSmith Kline Biologicals, Belgium supported health center. The study also assessed the influence of some maternal factors to immunization uptake.	A cross-sectional survey that enrolled mother of 339 children between the ages of 12 months and 23 months. Interviewer administered questionnaire was employed in the study, making use of WHO/EPI survey instruments and design. Chi-Square test statistic and multiple logistic regression models were used for data analysis.	60% full vaccination coverage with 55.5% vaccination document retention rate Mothers knowledge of immunization ($p = 0.006$) Use of privately funded clinic ($P < 0.001$)

9	Oyo- Ita, Fakunle, Fajola & Edet (2012)	To examine the impact of shell petroleum Development corporation's (SPDC) assistance on expanded program on immunization performance, to determine full immunization coverage (BCG, DTP, OPV and measles) in the SPDC assisted states and assess factors that influence full immunization.	The study is a quantitative survey conducted between April and August, 2010 in 7 Niger Delta states of Nigeria. Participants (age 12 -23 months) were 2432 children selected through multi – stage sampling technique. EPI survey from was adapted for data collection. + Sample size was based on 6.5% precision, 5% type 1 error, design effect of 2, and estimated coverage of 20.8%. Data was entered into Ms Excel and STATA softwares while logistic regression was used for data analysis.	Full immunization 65.2%. 95% partial immunization 4.5% not immunized with any vaccine. *OR* of full immunization 2.4 higher with nearness of facility.

Table A7

Factors Affecting Childhood Immunization Completeness and Timeliness

Citation	Purpose	Method	Result
Dummer, Cui, Strang, & Parker (2013) 10	To measure completeness and timeliness of childhood immunization among children upon 2 years of age in Nova Scotia	This was a cross – sectional study design that employed data collection from care giver history of vaccination, vaccination health insurance bill and public health records. The participants were children born in Nova Scotia from January 1 to December 31, 2006. The total study population was 8,245.	Childhood vaccination completeness: 49% for 12 months old, 40% for 18 months old 58% for 24 months old Completeness of vaccine is significantly higher among the unemployed (P<0.01) Age 12 months (OR = 1.5, 95%*CI:* 1.3, 1.8); Age 18 months (OR = 1.5, 95%*CI*: 1.3, 1.7); Age 24 months (OR = 1.7, 95*% CI*: 1.4, 2.0) Significantly higher for lower education group (P<0.001) - Age 12 months (OR= 1.7, 95% *CI*: 1.5, 2.1); Age 18 months (OR= 1.7, 95% *CI*: 1.5, 2.0); Age 24 month

			(*OR*= 2.0, 95% *CI*: 1.7, 2.3); + Immunization information from vaccination cards provides the “GOLD STAND”

Table A8

Factor Affecting Complete Immunization among 12-23 Month Old

Citation	Purpose	Method	Results
Etana & Deressa (2012) 11	The study evaluated factors influencing complete immunization among 12 to 23 months old children in Ambo Woreda district of Ethiopia	A cross-sectional survey of randomly selected 536 mothers from ambo Woreda district of Ethiopia. Structures interview was employed in data collection between January and February 2011. Crude association was determined with binary univariate logistic regression. Multivariate regression analysis was used to analyze full immunization predictors.	Immunization for BCG (71.1%) and OPV (74.6%). – Antenatal care (*AOR* = 2.4, 95% *CI*: 1.2 – 4.9) – Health Facility delivery (*AOR* = 2.1, 95*% CI*: 1.3 – 3.4) – Maternal Knowledge of immunization commencement age (*AOR* =2.9, *CI*:1.9-4.6) Limitation: - recall bias - selection bias+ Vaccination document retention = 41.8% + Complete vaccination coverage 35.6% + Received at least one immunization 76.3% + 23.7% had not received any immunization.

Table A9

Yellow Fever Vaccine Coverage Rate and Reasons for not Accepting Vaccination

Citation	Purpose	Method	Results
Bagonza, Rutebemberwa, Mugaga, Tumuhamye, & Makumbi (2013)	To access yellow fever vaccine coverage rate and reasons for not getting vaccinated	Cross sectional survey involving 680 respondents WHO EPI survey form questionnaire was employed as survey instrument A village is a cluster	Coverage rate was 96.1% with card retention rate of 51.6% within 3 months of vaccination. Immunization 96.1% (95%CI: 94.9 -97.8) – Immunization document 51.6% (95% CI: 47.2 – 56.1) – Reasons for not vaccinated, - travelled 40%, - lack of transportation means 28%

Table A10

Maternal Factors and Childhood Immunization Coverage

Citation	Purpose	Method	Result
Adeyinka, Oladimeji, Adeyinka, and Aimakhu (2009)	Determine immunization coverage, attitude and awareness among mothers of under 5 to immunization	Descriptive cross-sectional survey conducted at Igbora, Oyo State. 503 mothers were studied with questionnaires. The questionnaire had 35 items and its validity was discussed	Full immunization coverage was 76.9%, partial 22.4%, not immunized 0.7%. Sociodemographic condition not significant Reasons for not immunized: waiting period (46.1%, payment to private clinics (20.2%) and distance (17%) Note: under 5 mortality rate in Nigeria in 201/1000. it has other global data.

Table A11

Parental Belief in Immunization Benefit and Full Childhood Vaccination Coverage.

Citation	Purpose	Method	Result
Smith et al (2011)	To investigate the influence of parental belief on immunization benefit and refusal to vaccinate or delay to full childhood immunization in the U.S.A.	This was a cross-sectional study utilizing National Immunization Survey (NIS) data. Data on full immunization, the dependent variable were collected from the NIS. Immunization delay and refusal information were collected from NIS too while data on parental belief were collected from parents according to health belief index domain. T-test statistic was used to analyze the differences.	Delayed immunzi-25.8% Refused immunzi-8.2% Refused and delayed-5.8% Parents in any or both of The above category: -Lack belief on vaccine Benefits and safety -Situation more likely to affect immunization negatively. Limitation: NIS is a telephone based survey consequently; eligible households without landlines will be excluded from the survey.

Appendix B: Survey Form

Childhood Immunization Coverage Questionnaire for Mothers.

Section A: General Information

Please researcher will fill in the spaces provided appropriately

1Form number…….

2 Cluster name ……

Section B: Maternal Sociodemographic Information

Please tick the most appropriate response

3 Place of residence: □ Urban □ Rural

4 Mother's Age

Less than 20 years □ 20 – 29 years □ 30 years and above

5. Mother's highest education level

□None □ Primary □ Secondary □ Professional □ University

6. Marital status:

(a) Single

(b) Married

(c) Devoiced

(d) Widow

7. Number of antenatal visits made during your last pregnancy

(a) None

(b) Once

(c) Twice

(d) Thrice

(e) More than thrice

8. Number of people in the household

(a) Less than 3

(b) 3-4

(c) 5-6

(d) More than 6

9. Family income

□ Less than 20,000 Naira per month

□ 20,000 – 150,000 Naira per Month

□ 151,000-400,000 Naira per month

□ Over 400,000 Naira per month.

10. Facility of child's delivery

□ Hospital/Clinic/Health Center/Maternity Home

□ Home

□ Traditional Birth Attendant (TAB)

11. Distance to immunization facility from home

□ Less than 1km

□ 1 – 2 km

□ More than 2km

Section C: Childhood Immunization Information

Please fill in the most appropriate choice in the space provided

12. Child's birth date …….

13. Immunization card Yes/No……

14. BCG Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

15. DTP_1 Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

16. DTP_2 Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

17. DTP$_3$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

18. OPV$_1$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

19. OPV$_2$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

20. OPV3 Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

21. HEB$_1$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

22. HEB$_2$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

23. HEB$_3$ Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

24. Measles Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

25. Yellow Fever Date……

Mother reported immunization: Yes/No…….

Source of immunization service

□Outreach □Hospital □Health centre □Private

□NGO □Supplementary (SIA)

26. Immunization status

□ Not immunized □ Partially Immunized □ Fully immunized

Section D: Information on other Variables

Please tick the most appropriate response in each case.

27. I am happy with the postnatal services received in the health centers

a) Very much unhappy

b) Unhappy

c) Sometimes happy

d) Happy

e) Very much happy

28. I am willing to recommend the postnatal services to friend and family

a) Very much unwilling

b) Unwilling

c) Sometimes willing

d) Willing

e) Very much willing

29. Immunization documentation (card) is important for

a) Identifying which immunization is given and due

b) Identifying the child's immunizable age

c) Identifying where the child is born

d) Identifying where immunization centre is situated

e) Identifying agency that sponsored the immunization

30. Childhood immunization services is important for

a) Preventing all childhood diseases

b) Preventing childhood malnutrition

c) Preventing childhood vaccine preventable diseases

d) Preventing childhood malaria

e) Preventing childhood parasitic worm infections

31. How often does the baby's father discuss the benefits of childhood immunization?

□ Never, □Almost never, □Sometimes, □Often, □Very often

32. How often does the father of the baby criticize childhood immunization?

□Very often, □Often, □Sometimes, □Almost never, □Never

33. How often does the father of the baby finance baby's immunization?

□Never, □Almost never, □Sometimes, □Often, □Very often

Name of the interviewer Signature of interviewer

…….. ……..

Appendix C: Informed Consent Form

Dear Respondent,

Thank you for agreeing to participate in this study by filling out this survey form. Please know that your decision to participate in this study is from your free will. You will be required to fill this survey form once and it may take 20 munities to fill out. Your participation in this study will not bring you any gain or harm. And will in no way affect your children's access to health care. The survey form will gather information from mothers of children whose ages are between 12 and 23 months old. The information gathered may explain reasons for full childhood immunization in Owerri, Imo State of Nigeria for my doctorial dissertation.

I will maintain the confidentiality of every answer you give, so please feel free to answer correctly and honestly as much as you can. There is no way any answer you gave will be traced back to you and no information that can identify your person will be asked. Filled form will be stored in a locked cabinet for five years and there after the forms will be destroyed and disposed off.

This survey form will be distributed in Owerri. I will personally distribute and collect this survey forms and so will be happy to answer any question you may have or explain thing you want more information about now or thereafter. For any question that you may have, please feel free to e-mail me at osuala.kelvin@waldnu.edu or call 08033223504. If you want to talk privately about your rights as a participant, you can call

Dr. Leilani Endicott. She is Walden University's representative who can discuss this with you. Her phone number is 001-612-312-1210. Walden University's approval number for this study is 10-06-14-0249345 and it will expire on October 5, 2015.

Here are samples of the questions:

Distance to immunization facility from home

□ Less than 1km □ 1 – 2 km □ More than 2km

Please fill in the most appropriate choice in the space provided

Child's birth date …….

Is immunization card available? Yes/No……

When you collect the form please you are free to choose any of the options listed below:

Ask me to come back to the house within one week at your convenience to collect the filled survey form

Ask me to assist you in filling the survey form at any day and time that is convenient to you

Ask me to wait for some times to collect the fill survey form

If you agree to participate in this study please complete the survey. No signature or any other identifying information is needed from you. Please keep this form for your record

Once again I thank you very much for participating in this study.

With Much Appreciation,

Osuala Kelvin

Walden University.

Curriculum Vitae

Osuala Kelvin

Work Experience

Secretary/Registrar
West Africa Health Examination Board
Lagos
2008 – Date

- The Chief Executive Officer, providing all necessary managerial oversight functions of the organization's secretariat.
- Collaborating with the West African Anglophone member countries.
- Initiating and supervising curricula developments and innovations.
- Ensuring curricula implementation monitoring in the relevant institutions.
- Professional skill evaluation and certification
- Organizing training workshops to build human capacity for the training institutions and universities.
- Monitoring training resource developments among institutions.
- Preparing annual work plan and budget for the Board.
- Monitoring the implementation of Board's programs and ensuring capacity building for the Board.
- Reporting to the member countries through the Board of the West Africa Health Examination Board.

Deputy Secretary/Registrar
West Africa Health Examination Board
Lagos
2004 – 2008

- Officer-in-charge of the professional examinations (namely, environmental health, public health nursing and food hygiene).
- Arranging necessary logistics for the administration of the examinations in over fifty centers throughout Nigeria.
- Arranging and supervising the marking of scripts, collation of scores and preparing results for publication.
- Participating in the drawing of model questions and answers.
- Printing of the examination questions and packaging the questions for administration.
- Providing reports on the conduct of examinations and the performance of candidates in the examinations.

Assistant Chief Environmental Health Officer
Port Health Services, Federal Ministry of Health
Port Health Services Office, Seme Border,

Lagos.
1999 – 2004

- Coordinating the staff and all public health activities in the border.
- Holding meetings with all the government and non-governmental agents at the border on public health matters to ensure general environmental and disease control.
- Creating reviewing emergency preparedness plans and actions and managing public health emergencies.
- Fostering and managing collaborations with authorities from the Benin Republic on international health matters.

Principal Environmental Health Officer
Port Health Services, Federal Ministry of Health,
Port Health Headquarters
Ikeja
1989 – 1999

- In charge of administration, statistics, education and training.
- Provide update and monitor system of reporting of events and activities from all the divisions and formation of National Port Health Services.
- Providing technical and administrative knowhow to all Port Health formations.
- Developing and implementing training programs for National Port Health Staff.
- Coordinating staff performance evaluation.
- Preparing and submitting to Federal Ministry of Health, annual budget, work plans, reports on National Port Health Services.

Senior Environmental Health Officer
Port Health Services, Federal Ministry of Health
Tin Can Island Ports
1984 – 1989

- Conducting international health surveillance, monitoring compliance with international health regulations, providing education and information to all port users on international health regulations.
- Liaising with the State and Local Government health authorities on emergency reporting and preparedness.
- Food sanitation and control
- Monitoring and supervising food handlers to ensure the sale of wholesome and hygienic food items.
- Conducting and maintaining standard in food and general hygiene.
- Holding meetings and consultation with the association of food vendors and custom licensing agents.

Environmental Health Officer
Port Health Services, Federal Ministry of Health

Apapa Wharf, Lagos, Nigeria
1982 – 1984

- Port Sanitation, liaising with officials of Nigerian Ports Authority, Local health authorities on solid and liquid waste management within the port area.
- Organizing and executing sanitary surveillance, prosecution of sanitary offenders.
- Carrying out public enlightenment campaign and education on environmental health issues relative to sea port environment.

Education and Certification

Ph.D candidate Epidemiology
Walden University,
Minneapolis, Mn.

Master of Public Health — November, 2008
University of Calabar
Calabar, Cross River State

Bachelor of Science (Ed) Health Education — April, 1996
University of Nigeria
Nsukka, Enugu State

Diploma for Teachers of Health Sciences — September, 1988
University of Ibadan, Ibadan
Oyo State

Royal Society of Health, London's — August, 1982
Diploma for Public Health Inspectors
School of Health Technology
Yaba, Lagos.

Professional Associations and Unions

Member and Vice Chairman,
Environmental Health Officers Association of Nigeria,
Lagos State chapter, 1989 – 1992.

Member and Chairman Medical and Health Workers Union,
Port Health Branch, 1990 – 2004

Committee Assignment

Committee on Review of Nigerian Quarantine Regulations 1990

Publications
Not yet.